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The Official Journal of the American Academy of Cosmetic Dentistry®

JOURNAL of Cosmetic Dentistry



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SUMMER 2010

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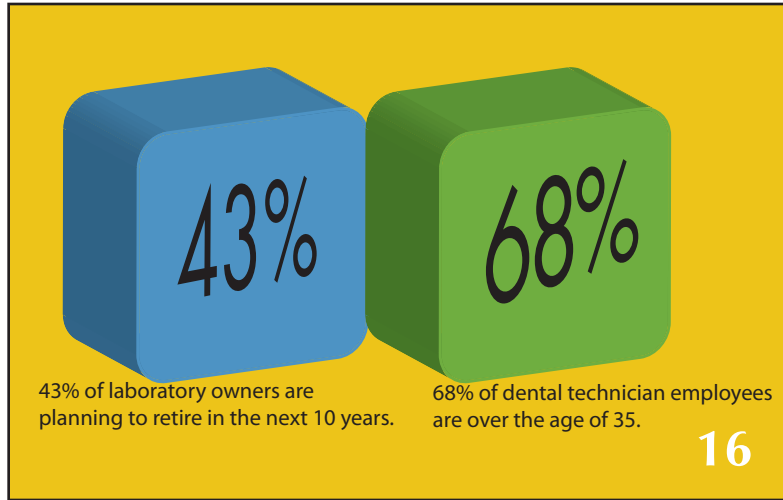
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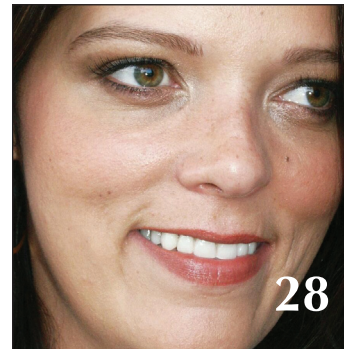


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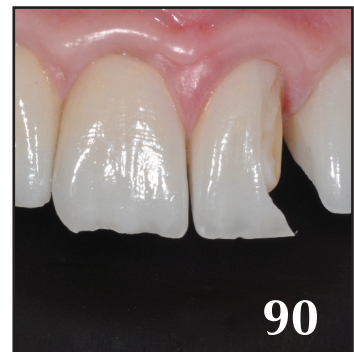
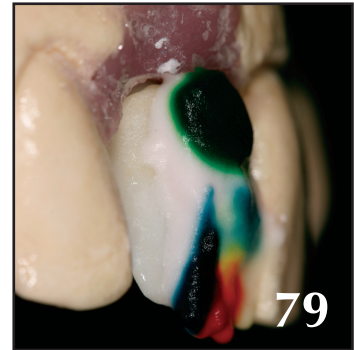
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AACD MISSION STATEMENT

The American Academy of Cosmetic Dentistry is dedicated to advancing excellence in the Art and Science of Cosmetic Dentistry and encouraging the highest standards of ethical conduct and responsible patient care.



THE BEST OF THE BEST

This is the first issue of the *Journal of Cosmetic Dentistry (JCD)* under my editorial direction. Like the illustrious editors before him, my good friend Dr. Mike Koczarski spent numerous hours enhancing the quality and content of our Journal. On behalf of all AACD members, I would like to thank him for his enthusiasm and commitment to excellence during his unprecedented six-year tenure.

During this summer's board meetings at the AACD's headquarters in Madison, Wisconsin, I decided to trace the origins of the Journal. Managing Editor Tracy Skenandore and I uncovered half-a-dozen cardboard storage boxes containing copies of every issue of the Journal, from its inception.

We discovered that the Journal began as a six-page foldout with blue-and-white photographs and blue text with red headings. It resembled a simple brochure that any child could easily create with today's computer software.

The inaugural Fall 1985 issue featured a scientific article by Dr. John Kanca about posterior composites and a "Q and A" section with Dr. Michael Miller about glass ionomer cements. Elements of our *Academy Connection* newsletter were also present to provide members with organizational content.

It is incredibly gratifying to see that the *JCD* has kept pace with the Academy's growth and advancement through the years. In this issue, we pay homage to laboratory technicians who partner with dentists to design and create exceptional-looking restorations and smiles. The business of dental technology is changing dramatically, and dentists are well advised to "step into a lab technician's shoes" in order to prepare for whatever challenges lie ahead. The state of the dental laboratory industry is

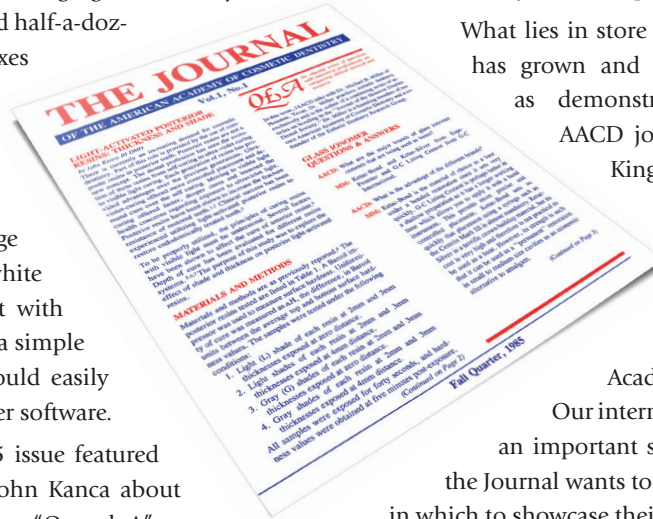
well outlined in the special feature by *Lab Management Today* editor Kelly Carr. We welcome the readers from *LMT* and the National Association of Dental Laboratories as we send this issue to them digitally.

In a new feature, "Visually Speaking," Juan Olivier, CDT, MDT, showcases a pictorial on the diagnostic wax-up process. Luke Kahng, CDT, offers a clinical article about the effects of dehydration on tooth surface texture. Also, Pinhas Adar, CDT, MDT, interviews renowned master ceramist Willi Geller, who shares his insights and wisdom on many diverse topics.

What lies in store for the *JCD*? The Academy has grown and become more globalized, as demonstrated by the upcoming AACD joint meeting in the United Kingdom, highlighted on page 26. As a Canadian, I embrace this global way of thinking and am proud to be a member of the American Academy of Cosmetic Dentistry.

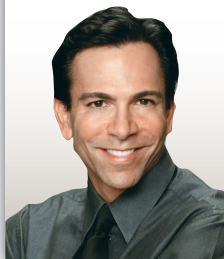
Our international members represent an important segment of the AACD, and the Journal wants to provide them with a venue in which to showcase their talents. As the new editor, I would like to personally invite more international members to contribute to the *JCD*.

There has been much debate over whether the *JCD* should remain a trade-type publication, featuring multiple case studies; or if it should evolve into a purely scientific periodical in which the articles can be cited and referenced in a medical database such as PubMed. The jury is still out on this issue, but we are leaning toward a balanced scientific journal that is both enjoyable to read and highly respected as a top-tier clinical authority. The editorial team and I are working hard to make this happen.



continued on page 14

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BEING AT THE RIGHT PLACE AT THE RIGHT TIME

"What we do as a community, as a society, for each other, matters as much as what we do for ourselves."
—Malcolm Gladwell

How do we achieve success, and how do we help others do the same? Malcolm Gladwell's book *Outliers* addresses exceptional people, including the Beatles; Bill Gates; and physicist J. Robert Oppenheimer, who led the Manhattan Project. In the introduction, Gladwell lays out the purpose of *Outliers*: "It's not enough to ask what successful people are like. It is only by asking where they are from that we can unravel the logic behind whom succeeds and who doesn't." Throughout the book, he discusses how family, culture, and friendship each play a role in an individual's success.

One of the most fascinating success stories is that of Bill Gates' formative years. As an eighth grader at the exclusive Lakeside School in Seattle in 1968, he had unlimited access to a computer terminal at a time when even college professors in computer science did not have this opportunity. Gates was fascinated by the machine and how it always executed software code perfectly. Spending endless hours with friends including Paul Allen, he created the Lakeside Programmers Group. By the time Gates graduated high school, he had thousands of hours of working experience. By the time he dropped out of Harvard at age 21 to found Microsoft with Allen, he was miles ahead of most other computer enthusiasts.

Although Gates can fairly be called a genius, there are some key themes that all of us can "take home":

- He worked very hard and took advantage of every opportunity that was presented to him.
- He was surrounded by friends who not only shared his passion, but also were talented in their own right. They mentored each other.
- Born around 1955, Gates and his friends were positioned at a perfect time in history—as was Steve Jobs of Apple Computer. The Alltair 8800, the world's first personal computer, was popularized in *Popular Electronics* in January 1975, when all of them were young enough to be risk takers and old enough to have the resources to do it.

While being provided every possible advantage and working hard, being surrounded by a culture of passion and a powerful community of people at the

right place in time helped catalyze their success more than individual intelligence or talent.

This thinking certainly applies to the personal stories of many AACD members.

- Becoming a dental professional requires a tremendous amount of time and dedicated hard work. However, merely graduating from school is never enough—it is just a beginning.
- Being open-minded to new technologies and continuous learning creates greater prospects for growth.
- Joining the profession at a time of electrifying growth in cosmetic and implant dentistry, as well as laser and digital technology, has been a tremendous boon for all of us.
- Coalescing that mix of knowledge and opportunity is membership in the AACD. The Academy welcomes and educates people with diverse backgrounds and perspectives from all over the world and has created a credentialing standard of excellence that is highly respected throughout our profession.

The AACD provides us with the chance to share our expertise, our experience, our philosophies, and our passion about what we do. Honestly collaborating is how we can bring value to one another, to this organization, and to our profession.

It is through this sharing that we grow, but perhaps more importantly, it is through sharing that we help others to grow. This has been a core value in the Academy since its inception.

Over the next year, our Academy will build greater opportunities on grassroots, global, and social media levels so that you will find greater value both personally and professionally, as well as resources to help others grow.

Taking advantage of the many possibilities the AACD community provides will be your own secret weapon for success. In partnership and friendship,



Hugh Flax, DDS, President
AACD Accredited Member
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ABOUT THE COVER



satisfied

listen

"To say I wasn't happy with the way my smile looked after my teeth were prepared and the temporary restorations were placed is an understatement. I saw four dentists and endured a lot of emotional distress before I found someone that I felt had the expertise to satisfy my expectations."

~ Denise Arnesen, patient

"As esthetic and restorative dentists and technicians we tend to attribute successful outcomes to sound knowledge, thoughtful clinical judgment, and technical expertise. We would do well to be reminded that successful results also center on our ability to effectively communicate with our patients."

~ Elizabeth M. Bakeman, DDS, AACD Accredited Fellow

For the complete clinical article, see page 60.

Restoring Dentist: Elizabeth M. Bakeman, DDS (Grand Rapids, MI). Laboratory Technician: Brad Patrick, BSc (Bend, OR). Cover photography: Tina Derusha, Artistry by Sonatina (Grand Rapids, MI). Hair and makeup: Tanáz Hair Boutique & Day Spa, Caurey Byers and Christine Burgess (Grand Rapids, MI).

communicate



Preoperative



Postoperative

Happy



Happy



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by David F. Halpern, DMD, FAGD
Immediate Past President,
2009-2010
Academy of General Dentistry
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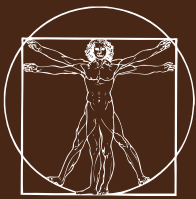
FAMILY TIES

If you have brothers or sisters or multiple children, you may find it interesting to observe the similarities and differences between siblings. While they might look dramatically different or have taken completely different paths in life, there are always a few qualities that serve as a reminder that they are part of the same family. This is the case with the Academy of General Dentistry (AGD) and the American Academy of Cosmetic Dentistry (AACD). Although AACD members may have taken a specific professional path in their dental careers, the composition of our organizations is similar in that almost all of our members are general dentists. This, along with our common goal of advancing the value and excellence of dental care, reminds us that we are all part of the same family—organized dentistry. Our “family values” can be seen in our similar missions: encouraging excellence through continuing education (CE), supporting respected credential designations, protecting professional practices, and promoting oral health information to the public.

As members of the same family, the AGD and the AACD are fortunate in that we can look to each other for support and collaboration when working to advance our common goals. The cross-promotion of CE opportunities is an excellent example of such collaborative efforts. Since CE is a pillar of both organizations, keeping members informed about beneficial CE opportunities is important to both the AGD and the AACD. Efforts—such as exchanging ads about CE events in our publications, as well as messages from leaders that encourage attendance at our fellow association’s annual education session—help to improve our memberships’ access to quality CE, which can help our members get one step closer to earning highly sought-after education and credentials. Could we do more together? Absolutely! There needs to be more “out-of-the-box” thinking along the lines of coordinated annual or regional meetings and symposia between our two groups, and I strongly encourage more energy directed toward these efforts.

Members of the AGD and the AACD put much time and effort into achieving their education credentials, and both organizations must work hard to protect

continued on page 14



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GUEST EDITORIAL CONTINUED

their members' rights to promote those professional designations. In 2009, the AGD worked with the AACD to support the efforts of the American Academy of Implant Dentistry (AAID) as it lobbied and litigated to stop a Florida state regulation that required the advertisement of non-specialty credentials and awards to include a burdensome disclaimer stating that the credentials or awards were not affiliated with recognized dental specialties, and that those designations were not attained through an accredited dental organization. The AGD and the AACD were grateful for the AAID's tenacious efforts to help thwart this potential regulation, and our organizations always stand ready to assist in protecting general dentists' rights to promote their well-earned and respected achievements.

The AGD and AACD's ability to join forces and challenge legislation that harms the professional practice of our members is another important example of how our organizations are linked. Advocating for our

core beliefs is an important part of maintaining the integrity of our profession and improving the quality of the care that we provide to our patients. Our collaborations allow us to hold tight to these beliefs and, in turn, provide our patients with the best care and promote the importance of proper oral health practices to the public.

While the AGD views AACD members as part of our family in the figurative sense, AACD members can make the family connection literal by becoming a member of the AGD, and vice versa. In fact, I and hundreds of my AGD colleagues are also proud members of the AACD. When you join the AGD, you can take advantage of the numerous benefits offered by the organization—and you strengthen the voice of organized dentistry. For the AGD to continue to be the "voice of general dentistry" and deal with third-party payer and insurance issues, health care reform, dental materials usage, expanded use of the dental team workforce and lessening the influence

of mid-level providers, and the myriad of other discussion focal points in the advocacy arena, we need to increase the number of voices we represent. I would like to formally invite AACD members—the AGD's brothers and sisters—to join our immediate family so that we can work even more closely together to strengthen our family ties.

In addition, continued discussion of common interests needs to occur, and a commitment to increase the value of membership in both of our groups by developing mutually beneficial programs must be established. Both our "families" will benefit and, more importantly, we will advance the excellence of dentistry and the delivery of quality care to the public we serve.

On a personal note, during my years of leadership in the AGD, it has been my most sincere pleasure to have served with and developed friendships with outstanding AACD leaders, such as AACD Past President Dr. Michael R. Sesemann.



EDITOR'S MESSAGE CONTINUED



In my opinion, change is invigorating. By taking the best of the best from previous years, adding a dash of the new, and tossing in a sprinkle of adventure, I envision a new look, new sections, a new editorial board, new ideas, and perhaps a renaissance of "old" ideas.

I believe that you will enjoy this Summer issue of the *JCD* as much as the editorial team and I enjoyed developing it. We welcome your feedback and suggestions as we strive to remain relevant in these changing times.

Cheers,

Edward Lowe, DMD,
AACD Accredited Member
Editor

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DENTISTRY IN TRANSITION: THE AGE OF CHANGE IN THE DENTAL LABORATORY INDUSTRY



by Kelly Fessel Carr
Editor, *LMT Magazine*

INTRODUCTION

Never before has the dental laboratory industry been in such flux. Digital technologies are on the rise. Restorative options are expanding. The global market is increasingly competitive. Technology schools are closing. Industry members are growing older, with many owners preparing to retire. Long characterized as a “cottage industry,” the dental laboratory community is increasingly becoming more sophisticated and is steadily attracting the attention of private equity firms.

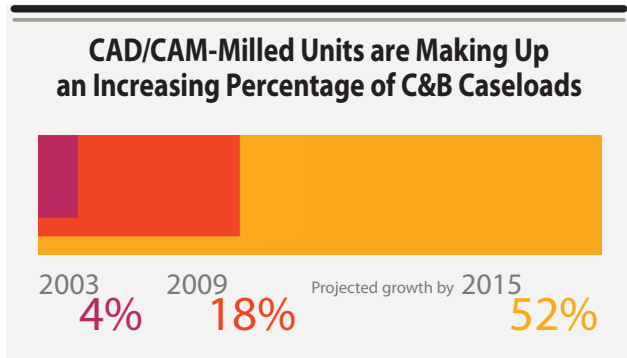
Much of this change is technology-driven. While still in its infancy, digital technology is already having a significant, positive impact on the dental team. From printed wax-ups to milled copings, abutments, and full contour, automated systems give the dental team access to the latest restorations and materials.

The proliferation of computer-aided design/computer-aided manufacturing (CAD/CAM) and rapid prototyping systems in the laboratory marketplace is improving the quality and consistency of restorative work, impacting the way laboratories and dentists work together and enhancing their partnership approach to dentistry.

Every five years—*LMT, Lab Management Today*, a leading business strategies magazine for dental laboratory owners and managers in the U.S.—conducts a “State of the Dental Laboratory Industry” survey to track market trends among dental laboratories and their dentist-clients. Here are the highlights of our 2010 survey:

THE DIGITAL CASELOAD

CAD/CAM-milled restorations are accounting for an increasing percentage of laboratories’ crown and bridge caseloads. In fact, the percentage has more than quadrupled since 2003: Seven years ago, CAD/CAM-milled units represented an average of 4% of crown and bridge workloads; now, it is 18%, according to *LMT’s* survey respondents. And survey participants predict that, by 2015, more than half of their total caseloads—52%—will be CAD/CAM-milled restorations.



Source: LMT Research Dept. ©2010

But while many laboratory owners are fired up about—and investing heavily in—digital dentistry, getting many of their dentist-clients on board is another story. Only half of our survey participants' dentist-clients are interested in trying new technologies and only 34% of their clients are prescribing CAD/CAM-milled restorations. The others prefer to stay with traditional porcelain-fused-to-metal restorations.

Clearly, much of adopting any new technology hinges upon a person's willingness to adapt to change. Nowhere is this more evident than with digital impression-taking systems. Laboratory owners are excited about the accuracy, fit, and decrease in remakes they are seeing with the use of these systems (inadequate impressions are the number one complaint laboratory owners cite about the cases they receive from dentists, just as inconsistent quality is the number one reason dentists switch laboratories).

So what holds a dentist back from adapting to a system that ensures more accuracy? Cost, for one thing: In addition to the initial investment in the technology, there are the "click fees" associated with each digital impression and the digital models that are two to three times the cost of a plaster model.

Survey participants report other reasons their dentist-clients are resistant are because they are uncomfortable with the technology, are not computer savvy, or simply do not want to make a switch. Thus far, only 18% of LMT's survey respondents say they are receiving digital impressions from their dentist-clients and they are receiving them only from an average of 11.5% of their customer base!

DENTIST-LABORATORY RELATIONSHIP

Dental schools have dramatically cut back on the amount of technology training their students receive. This means that some younger dentists have never performed laboratory procedures, have had limited contact with technicians, or do not fully understand the value of closely interacting with technicians.

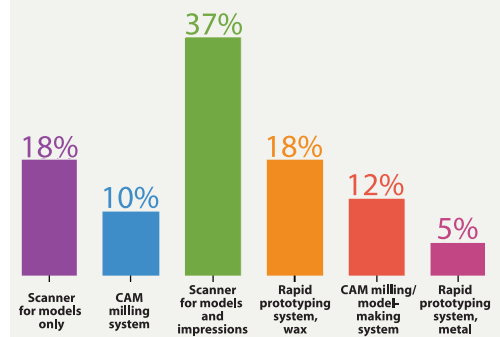
For years, dentists have been increasingly relying on their labs for their product expertise and technical advice. The decline in technology training in dental schools, compounded with the explosion in new digital technologies, has taken this trend to a whole new level of partnership and one-on-one communication.

Just as manufacturers have taken a leadership role as educators to the lab community, laboratory owners are taking on this role with their dentist-clients. All eyes are on the laboratory community as technology leads the way. In fact, every year, over 5,500 laboratory decision makers—half the entire community—turn out to attend lectures, take hands-on seminars and see the exhibits at LMT's educational Lab Day programs.

In conjunction with this positive trend, an increasing number of laboratory personnel are attending continuing education courses side-by-side with dentists. About half of our survey participants do so, with 62% saying the number of courses they attend with dentists has increased in the past five years. Members of the dental team have learned to relate positively to one another as "educated equals."

50% of Survey Participants Plan to Purchase Digital Equipment in the Next Two Years; Here's What They Want to Buy:

At the top of many shopping lists: a model/impression scanner.



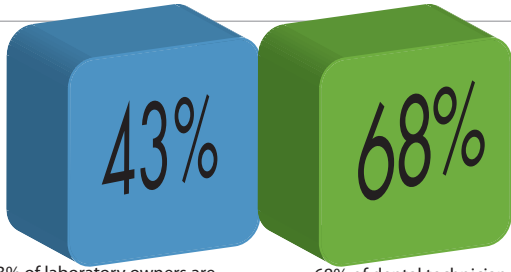
Source: LMT Research Dept. ©2010

Continuing Education: Attending Courses with Dentist-Clients

Sixty-two percent of survey respondents say they're taking more courses with dentists. Here's a look at how much of their continuing education is done alongside dentist-participants.

None	30%
1-25% of total CE	37%
26-50% of total CE	14%
51-75% of total CE	10%
76-100% of total CE	9%

Source: LMT Research Dept. ©2010



43% of laboratory owners are planning to retire in the next 10 years.

68% of dental technician employees are over the age of 35.

Source: LMT Research Dept. ©2010

WHAT THE FUTURE HOLDS

Most industry experts believe that traditional craftsmanship will give way to digital technology when it evolves to the point that it is *replacing* all the manual fabrication steps. Laboratories of the future will likely fall into two distinct business models: high-end, boutique laboratories devoted to esthetics; and centralized digital processing centers dedicated to high-volume production.

Ultimately, restorative dentistry will be a completely digital process, eliminating the need for physical impressions and solid casts, reducing the need for remakes, and eradicating much of the guesswork in terms of function, shape, and esthetics between the dental team members. In this 3-D world, there will be more meaningful, upfront communication, giving both the technician and the dentist greater confidence in the outcome of the case.

These advances in dental technology could not have come at a better time. Within the next 10 years, 43% of laboratory owners are planning to retire; 68% of dental technician employees are over the age of 35. As labor-reducing digital technology becomes more prevalent, it will take fewer technicians to accomplish the same amount of work. This reduced need for technicians could peacefully coincide with the aging of our industry.

Keep in mind that these systems have an immense capacity. Laboratory operators who invest in these systems—aware that the dentist-per-laboratory ratio will increase as baby

boomers push past retirement age—will be well positioned for this huge demographic change.

A COTTAGE INDUSTRY IS “DISCOVERED”

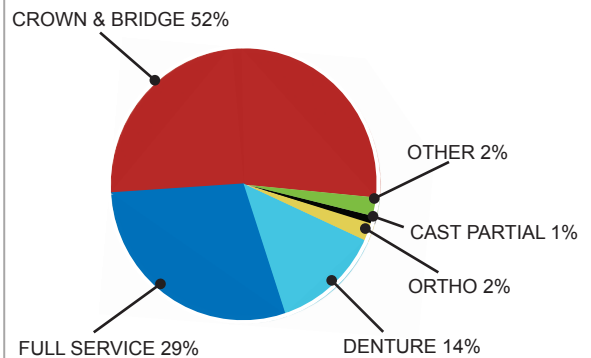
Industry analysts have long predicted the demise of the small and/or mid-size laboratory, and if economic conditions ever were ripe for attrition, it is now. Thus far, however, LMT’s circulation data shows no attrition, and circulation figures have remained consistent during its 26-year history. Just as in 1984, there are still approximately 11,200 laboratories (including in-house) in the U.S.; about 73% are one-to-five-person labs.

As dentistry is one of the fastest-growing segments in the medical technology field, it makes further sense that these demographics may change. Of late, there has been a flurry of merger and acquisition activity, and private equity firms have discovered the dental laboratory community

The interest from big business is a significant compliment to the dental laboratory industry and how far it has come. Even 20 years ago, many laboratories were considered “mom and pop” operations. Today, there are many—of all sizes—that are professionally managed, high-tech, and business-savvy. Many laboratory owners are optimistic and see a bright future, including the 23% of LMT’s survey participants who have opened their labs during the last 10 years.

Demographics of the Dental Laboratory Industry

BREAKDOWN BY LAB SPECIALTY



OF EMPLOYEES

1-2	45%
3-5	28%
6-10	11%
11-15	4%
16-20	3%
21-50	5%
50 plus	4%

REGIONAL DISTRIBUTION

New England	5%	West South Central	7%
Middle Atlantic	15%	Mountain	8%
East North Central	16%	Pacific/U.S. Territories including APO/FPO	21%
West North Central	6%	Paid Canadian & Foreign	2%
South Atlantic	17%		
East South Central	3%		

ANNUAL REVENUE

UNDER \$250,000	62%
\$250,001 to \$500,000	17%
\$500,001 to \$1,000,000	11%
OVER \$1,000,000	10%

Source: LMT Research Dept. ©2010

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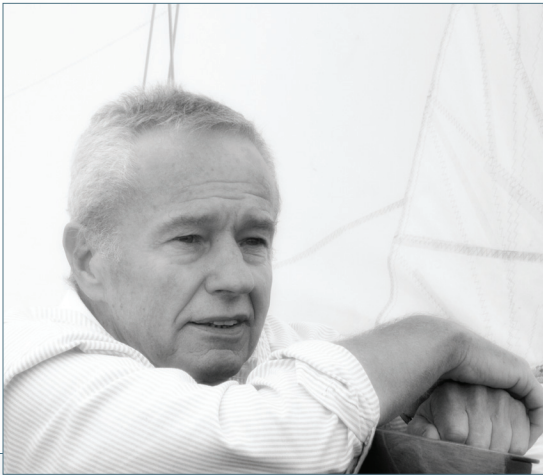
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INSIDE THE MIND OF WILLI GELLER, MDT—PART 1

Willi Geller, MDT (Zurich, Switzerland), is known around the world as a master in the dental industry. His philosophies extend beyond those about technical excellence; in this interview he shares candidly with one of his students, Pinhas Adar, CDT (Atlanta, GA), about his learning path, his inspirations, and his thoughts regarding the dentist-ceramist relationship.

Mr. Geller will be presenting at the 27th Annual AACD Scientific Session in Boston, Massachusetts, May 18-21, 2011. Save the date and register online today at AACD.com.

PA: *Willi Geller is one of the most innovative and respected dental ceramists in the world. Most people already know that he led the industry with his skills in mimicking the natural dentition in ceramic. But what some might not be aware of is that technicians initially were not very respected in the field of dentistry. Willi was the one who actually changed that mindset. He paved the way for the rest of us in this profession, so that technicians have an equal partnership with other professionals in the business; we just have different careers in the same field. It has been an incredible experience to have Willi as a mentor and a friend, because he had to fight so hard at the beginning to make so many things possible for us today.*

Many people who teach about natural-looking ceramics or interproximal space closure might take these things for granted. But someone actually had to fight for these things to become the norm. Willi is very passionate about what he knows is right; because of that, closing the interproximal spaces is the standard in dentistry.

PA: *Willi, could you please describe your own path of learning, from the beginning?*

WG: *First of all, I truly love my profession. There are people who assess what I do, and call it "quality" or "beautiful." However, at the beginning of my career, someone employed me. My colleagues would come to me and have questions about how to do some*



Willi Geller, MDT, with former student Pinhas Adar, CDT

of the things that I was doing and I would show them. That was the start of my teaching career—it was purely by accident.

Many things that I have tried did not quite work out, but nobody knows about those things. I am naïve by nature, and enjoy doing things that I have no experience in. So, when I have an idea or realize that something is necessary, I just do it. It is like a child who touches a hot oven and only then knows that he will get burned. In this way, positive solutions are what are left. That's my natural way, which is what I am comfortable with. I'm not as educated or as smart as people think—maybe I just try more things. I also like taking risks.

PA: *So, what would you suggest to other people to help them keep an open mind?*

WG: To suggest to other people is very difficult, because each one has their own nature and personality. Some can improve a lot by learning from other people, but others are different, so they should do it their own way, the way that feels right for them.

PA: *What influenced and inspired you along your path?*

WG: I came from a very wonderful family and had very good parents. And throughout my life I was always lucky to meet more wonderful people. I lean on that. I love people. That is the influence that I have had in my career.

PA: *Where does your continued inspiration come from? When*

you get up every morning, what drives you?

WG: Life itself is my inspiration; life is the motive for everything. I do not force ideas to come to me, they just do. I understand today more than I did before. The Far Eastern philosophy is to “empty” your head; if you do that and don't over-think things and don't become stuck in your thinking, you make room for intuition and the ability to learn. I meditate a lot, which helps to do that. Our minds, our bodies are full of garbage. We should cleanse our bodies, our minds, our spirits.

PA: *So, what you are saying is that we can learn new concepts and/or principles more easily if we are open-minded and don't get stuck with our old ideas. Is that correct?*

I always did what I wanted. That's also what I recommend to young people. They have nothing to lose, only to gain, but they should go their own way.

WG: Yes. If you always cook at home and never try other food, you might cook very badly, but you will never know. You only know when you have comparison.

PA: *Do you think that becoming a master ceramist is something that can be learned, or do you think it is an innate ability to see and to be able to visualize?*

WG: I think it is easier when you are born with some ability,

but you can also learn from others. Interesting, stimulating people can always inspire you. Esthetics is something that you either recognize or you don't.

PA: *What do you feel defines “artistry”? Is it the shape of the teeth, or the color? What do you think is the most crucial part of artistry in dentistry?*

WG: When the color is wrong or the shape is off it makes our job harder but I think, in general, shape is more important than color.

PA: *Shape is definitely something that people can learn easier than color, because color is subjective. Do you agree?*

WG: Yes. Even people who are not very artistic can learn geometric forms.

PA: *What, in your opinion, makes a great ceramist? And how can dentists find out, in advance, if someone is the right fit for them?*

WG: I think they must try each other out. That's the only way. Some people might be very good professionals—both the dentist and technician, but sometimes they do not work well together.

PA: *It is almost like a marriage, basically.*

WG: The tragic thing is that they depend on each other like married people do. They work together every day, and the “everyday routine” is not always easy for everyone.

PA: *What do you think is the secret of forming a great dentist-ceramist partnership?*

WG: You have to have a common language and be open-minded

without letting egos get in the way of that partnership. I think ego is the biggest obstacle that most professionals experience and that makes them become unwilling to learn and grow together. We need to be honest and straight with each other. Communication is a cultural aspect and a very strong one. I go to Asia often, and have seen that Asian people communicate very differently from the way we do. I always say that we are an arguing society. We argue with each other, and say bad things to and about each other, and then leave the other person with all that negativity. The only way that situation can be good is if you learn something from it. But we should fight fairly for our



opinions and understand that each person has their own perspective on things.

PA: *Maybe 20 years ago, when I first came to the United States, I had some challenges with arguments and respect and other work relationship issues. I remember that you gave me some very sound advice. You said, "Pinhas, if it's worth fighting for, fight for it." Now, let's talk about materials. You were instrumental in developing both the philoso-*

phies and the concepts for a lot of materials. When you worked with the Vita Company, you came up with the opacious dentin concept as well as other different products. Now you have your Creation ceramic line, which has incredible optical properties. Is there an aspect lacking in today's available materials that you still want to see produced?

WG: We have a lot of materials and can do many things with them, but then we get to the limit, and need another material to help us to achieve our artistry in dentistry. So it is and will always be a work in progress for materials.

PA: *Do you have any favorite restoration type for single teeth or multiple teeth?*



WG: I personally do a lot of metal ceramic, over 90% for crowns and bridges. I do a lot of all-ceramics for singles or partial restorations, and sometimes zirconium is very nice. I decide what type of materials I will use for each case; the dentist can request a certain type of material, but in the end, I determine what will be the best for the case.

PA: *The true structure and actual case dictates what product*

you're comfortable with. Is that correct?

WG: Yes, and a lot is dependent on the mechanics and stability of the patient's function. It is not good when someone says that they do everything with one technique or one material. You have to know what are the best materials and techniques available for the particular case and patient.

PA: *I agree. Now, let me ask what people always ask me about you: Do you have any background in art, such as painting or sculpting?*

WG: Yes, I do. But I am not good at painting because it is two-dimensional. I like to sculpt a lot. However, when I opened my own lab, I had to stop sculpting, because it's very



time-consuming. So, I started to collect sculpture instead. I also collect other forms of art. My experience with artists is that they are very intolerant, because they are interested only in their own work, whereas collectors can have many different works of art from many different artists.

PA: *Have you done intensive studies of natural tooth form and structure to be able to create beautiful lifelike restorations?*

WG: Yes, I learned from nature, as we all should, and I continue to do so. More than 40 years ago when I was working as a technician in a laboratory, one of my friends came to me, looked at my work, and said, "This is a typical Willi crown." I will never forget that; I did not like that statement. I don't want my work to look like "typical Willi"—I want it to look like nature. I constantly observe nature so that I can continue to learn from it and make my work better. Artistry is about creativity.

PA: *What is the key ingredient or information that you need from your dentist to create the proper communication? I know that you see patients as well, but if you have not seen*

the products have improved, and they have fluorescence and everything else that we need, so what is your secret to creating the lifelike vitality of a natural tooth?

WG: You must have a goal in mind, you need to know what you desire, and what you want to achieve. You should also know the material that you are using very, very well. Stay with the material until you can achieve the best results possible with it.

PA: *In other words, the key is to master the product you use so that it will be as good as it can be.*

WG: Yes—you have to know the product that is in your hand.

PA: *Besides dentistry, what are you passionate about? What is it*

WG: It is extremely unfortunate, but our profession is not very well compensated, especially if someone else employs you. Our work is hard and it is stressful. We must have more educated people and better compensation in order for this industry to grow. If someone has a really good education, they normally don't join our profession because of the low compensation. It is also hard to encourage people to get into our industry because of this.

PA: *Yes, it is a hard profession. My path wasn't that easy, and I know that yours wasn't either, because you were the one who actually changed things for us. The AACD is the only academy that actually embraces labora-*



the patient, what is it that you require?

WG: It's always good to have photographs with relaxed lips, one smiling, and a big smile; as well as intraoral photos and a full-face photo, either relaxed or smiling.

PA: *Do you also communicate via video?*

WG: A little. E-mails have made it much easier to communicate.

PA: *You were the first to mix stains and modifiers to create three-dimensional ceramics. Now*

that you love in life?

WG: I always have an eye on art. I also have a passion for sailing and I love people. I really love meeting and spending time with new people.

PA: *Dental laboratories and dental ceramics seem to be "fading away" in some countries, especially in the U.S. and Europe. What can the industry do to excite new people, "new blood," into pursuing a career in dental ceramics?*

tory people and respects how we work together with dentists to reach a common goal. Instead of just talking about it, the AACD actively supports people in coming together to network and talk, and build relationships. That's how we try to encourage people to join the profession.

WG: We do have some young ambitious people who are very good. We also have many young people in the Oral Design Group. They want to grow, and we should let them.

GELLER

They also want to present on stage. Because my time is very limited and I cannot always do that, it is very good that these young people want to share their knowledge.

PA: *The Oral Design Group, of which I'm proud to be a member, just celebrated its 25th anniversary in Switzerland. Can you tell readers something more about Oral Design?*

WG: I did not create the Oral Design Group; it was created by every single member we have. Each member contributes his or her ability, and not just in dental ceramics. I remember in particular Mark Anderson, who passed away, was not the greatest ceramist, but he was an exceptional teacher—I never saw a teacher like him. He was unbelievably good at getting other people excited about the profession.

Each member of the group has unique and powerful abilities. But that's not enough—we all respect each other's abilities, and do not try to get the other members to think in only one way. We are all open minded; this is amazing in such a big group. Each member knows what to do, and the steps necessary to get there; it is wonderful. I always say that we may be the best group in the world. Not each of us individually, but collectively.

PA: *What was the major turning point in your career that allowed you to do what you do now?*

WG: I always did what I wanted. That's also what I recommend to young people. They have nothing to lose, only to gain, but they should go their own way.

My generation changed the world, but what worries me about young people today is that they are too addicted to the things that they have... and seem to be afraid of the things that they have never had. Freedom is the true way to happiness and success.

In the next issue of the Journal of Cosmetic Dentistry, Mr. Geller shares more about his views on materials, the future role of laboratory technicians, and offshore laboratories. He also discusses his definition of "esthetics," the future and business aspects of esthetic and restorative dentistry, and what gives him professional satisfaction.

Black-and-white portraits courtesy of Mr. Sascha Hein (Perth, Western Australia).



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ESTHETICS MEETS AESTHETICS

by
Hugh Flax, DDS, President
AACD Accredited Member

Christopher Orr, BDS

As dentistry grows more global, it is critical that we gain a new view on the rapidly evolving world of techniques, technology, and materials.

During AACD Board meetings about two years ago, we had a “What if?” discussion. Imagine if we could bring together some of our finest European affiliates—with the AACD as a sponsor—to create an inspiring international symposium. Consulting with leaders of the British, German, and French affiliates, along with the European Society of Cosmetic Dentistry, we have partnered to create an AACD-type conference with continental flair.

The Fall 2010 AACD International Meeting will take place September 23-September 25 in London.

The two-and-a-half day meeting will feature:

- a keynote presentation on esthetically functional treatment planning by the distinguished Dr. Frank Spear
- internationally known speakers such as Drs. John Weston and Dennis Wells
- hands-on classes on composites, smile design, temporization, and lasers
- team approaches to complex cases and minimal preparation showing how the dentist-technician partnership can deliver very conservative esthetics
- discussions on evolving trends like social media, and the use of Botox and fillers
- an international showcase of speakers
- social events, including a special Welcome Reception at the historic House of Commons.

One of the seminars that will epitomize the vision we had for the meeting is titled, “Approaches to Smile Design: Mathematical vs. Artistic Interpretations.” It will be presented by Drs. Brian LeSage and Luca Dalloca.

As we all know, there are many ways to create a beautiful smile. Some clinicians set about the process with artistic flair, while others prefer a more logical approach. This session was created as part of the meeting’s advanced learning track so as to allow attendees with a working knowledge of esthetic treatment planning to hear a discussion in which the two methodologies are compared and contrasted.

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There is no right or wrong way, as both processes lead to a beautiful end result. The two are, however, far apart in terms of their core philosophies. This will not be a didactic session, but rather, one that requires active thinking and involvement from the audience.

Dr. LeSage will present the “logical” approach. Using AACD Accreditation criteria, he will discuss his methodology for analysis and design of a beautiful smile. This is familiar to all of us as a good set of rules to be used to identify the areas of a smile that need to be improved, and also as a means of analyzing a smile after treatment to see if the goals of treatment have been met.

Dr. Dalloca will present his “artistic” approach. Using concepts rooted in fine art, he will discuss how the nuances of visual perception can be used to create a smile that looks beautiful, yet seemingly breaks all the “rules.” The concept of artistic balance within a composition (in this case, the smile) is sometimes difficult to master, but Dr. Dalloca will draw on the right side of your brain to help explain his method.

After Drs. LeSage and Dalloca discuss their philosophies, a number of cases will be presented by the session moderator. Each speaker will illustrate how he would manage the treatment (without identifying who actually did the treatment). Following discussion between the moderator, the speakers, and the audience, the doctor who performed the treatment will then show the end result and how it was achieved.

When cosmetic dentistry’s premier organizations—the American Academy of Cosmetic Dentistry, the British Academy of Cosmetic Dentistry, the Dental University of Paris Study Group, the European Society of Cosmetic Dentistry, and the German Academy of Cosmetic Dentistry—gather to bring the most comprehensive cosmetic dental program in the world to Europe, responsible esthetics will set the stage for an incredible week of global education.

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PAY IT FORWARD



by David A. Schaefer, DMD
AACD Accredited Member
Louisville, KY
www.smilesloouisville.com

The AACD Charitable Foundation's Give Back A Smile™ (GBAS) program restores the smiles of domestic violence survivors at no cost.

We have received many success stories and thanks from GBAS volunteers and recipients. This section shares the triumphs of the GBAS program. Please visit www.givebackasmile.com for more information on how you can help restore a smile.

INTRODUCTION

Zenda Stakelbeck decided to celebrate the 30th anniversary of her beauty salon in a very meaningful way: She provided each of her salon's team members with \$1,000 to enrich someone else's life, thus initiating the "Pay It Forward" program.

Stylist Cristi Forrest contacted Teresa Kinberger, an attorney who works closely with women and families in difficult situations. Together they identified "Melissa," who had previously been in an abusive relationship but who was making a positive change in her life and was determined to succeed (Fig 1). Cristi decided she would help lift Melissa's spirit on the "inside" by contributing to positive change on the "outside."

Cristi decided she would help lift Melissa's spirit on the "inside" by contributing to positive change on the "outside."

The plan involved helping prepare Melissa for upcoming job interviews by enhancing her wardrobe with professional outfits, providing hairstyling services, and applying cosmetics to draw attention to Melissa's pretty facial features. However, Cristi immediately became aware that Melissa's self-esteem and willingness to smile were dramatically affected by the absence of any upper teeth and damage to several remaining lower teeth (Fig 2).

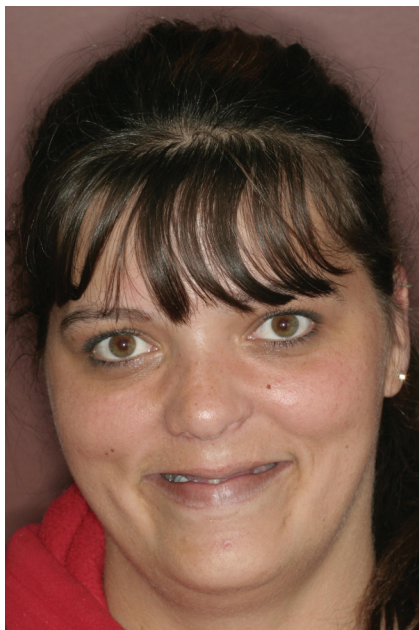


Figure 1: Preoperative full-facial view. Note the patient's closed-mouth smile.



Figure 2: Preoperative retracted view revealing the patient's edentulous maxillary arch and severely compromised mandibular dentition.

Cristi contacted our office to find out what could be done for Melissa's smile. Melissa's history of domestic violence brought the AACD's Give Back A Smile™ (GBAS) program into the picture, and a plan to restore her smile was put into motion.

TREATMENT PLAN

After Melissa underwent a thorough examination, our office began establishing a comprehensive treatment plan by consulting with implant manufacturers, specialists, and dental laboratories. Recognizing the opportunity to make such a positive impact on someone else's life generated a "can-do" attitude with each phone call. As a result, an overall treatment plan was finalized that included the following:

- preliminary complete maxillary denture

- extraction of hopeless teeth (##23-26, #30)
- periodontal surgery at time of extractions (##21, 22, 27, 28, and 29)
- endodontic treatment for ##22, 27
- four maxillary implants with an implant overdenture
- fixed partial denture at ##(20 x 21 x 22 x 27 x 28 x 29 x (30). Note that ##20 and 30 were cantilevered pontics, with true abutments at ##21, 22, 27, 28, and 29.
- mandibular nighttime biteguard.

THE RESULT

As with many complex multidisciplinary cases, the planning phase required input from all parties involved. These included the implant manufacturer (Nobel Biocare; Yorba

Linda, CA), oral surgeon, endodontists, dental laboratories, restorative dentist, and the patient. While putting our plan into action, additional teeth (i.e., ##21, 28, and 29) required endodontic therapy due to extensive decay. With perseverance, determination, and extra effort from all involved, a healthy and esthetic result was achieved and a life was changed for the better (Fig 3).

THE REWARDS

Zenda Stakelbeck's "Pay It Forward" program and the AACD's GBAS program were a perfect match that used resources, contacts, and creativity to help those in need. Melissa continued to make more positive changes in addition to her smile (Fig 4). She lost 33 pounds, found a better job, started a meaningful relationship, and became more involved with her family and community.



Figure 3: Postoperative retracted view of the patient's maxillary implant overdenture and mandibular fixed bridges.

As dentists, we know that improving a smile results in far more than giving teeth the proper color, texture, and contours. Cristi Forrest's idea enhanced Melissa's appearance on the outside and, more importantly, created a happier person on the inside (Fig 5).

Acknowledgments

The author thanks the following professionals who contributed their time, expertise, and resources to this case: Zenda Stakelbeck and Cristi Forrest (Z Salon and Spa; Louisville, KY); Teresa Kinberger (Louisville, KY); Dawn Burns, Julie Day, Connie Manning, Nancy Monzon, Suzanne Schaefer, and Missi Weber (Schaefer Aesthetic General Dentistry; Louisville, KY); Louann Hill (Nobel Biocare; Yorba Linda, CA); periodontist Michael Mehlbauer (Louisville, KY); endodontist Leslie Malueg (Louisville, KY); Chris Morris and Linda Gavin (ADL Dental Laboratory; Louisville, KY); endodontist Scott Norton (Louisville, KY); Grace and Stephen Park (Stephen Park Dental Laboratory; Lexington, KY).



Figure 4: Postoperative view.



Figure 5: Alternate postoperative full-facial view of the patient showing her natural smile.

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INTRODUCTION TO ACCREDITATION ESSENTIALS



by James H. Hastings, DDS
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With this issue of "Accreditation Essentials," we introduce a new co-editor, Dr. Jim Peyton. Dr. Peyton takes over for Dr. Ed Lowe, who is now editor of the *Journal of Cosmetic Dentistry*. Our heartfelt thanks to Dr. Lowe for his contributions this past year, and our congratulations on his selection for this important assignment.

Dr. Peyton is an Accredited Fellow of the AACD, the highest professional achievement in the Academy. Accreditation is his passion, and we welcome him as our newest contributing editor.

In preparation for entering and journeying through the Accreditation program, education and orga-

nization are essential for success. For the dentist wishing to enter the Accreditation program, it goes without saying that education and practice come first. For the laboratory technician, it is a bit different. He or she is dependent upon the dentist to possess the skills needed to proceed successfully, and to provide a patient whose case lends itself well to demonstration of the skills of both. Also crucial is the dentist's ability to supply Accreditation-quality digital images for the laboratory technician to use.

A synergistic relationship must exist between the dentist and technician. It was AACD Accredited Laboratory Technician Lee Culp who first

introduced the "Architect-Builder" concept, in which the dentist is the architect and the technician is the builder. The dentist-architect must provide the technician-builder with a set of "blueprints" that are accurate and sufficiently detailed in order to receive a product that matches the envisioned final outcome. Moreover, there must be close communication and mutual professional respect between the two.

A good working relationship between a high-quality laboratory technician and a highly skilled dentist can result in wonderful dental treatment. An important benefit of the Accreditation process is evaluation of the laboratory technician by

"It is not because things are difficult that we do not dare, it is because we do not dare that things are difficult."

~Seneca (1st Century A.D. Roman philosopher)

the treating dentist, and vice-versa. The dentist then might decide to work to improve the existing technician's skills, or find a new one who can provide the required results. This scenario also works the other way; if a laboratory technician wants to become Accredited, he or she needs to encourage the dentist to join the AACD and take classes to improve his or her skills so the laboratory technician can pass Accreditation cases. The end result is that the dentist and the laboratory technician learn to work better together to achieve superior results. The point is not only to pass Accreditation, but also to benefit both the dentist and laboratory technician for the rest of their careers with higher-quality results. And, of course, the patient is the final beneficiary.

In this issue, we showcase how restorations are created from a laboratory technician's point of view. In

both cases the treating dentist supplied extremely valuable information to the laboratory technician, did a superb job of handling the soft tissue, and provided a great foundation upon which the cases could be built by the laboratory technician. With a first-rate dentist and laboratory technician working together as a team, outstanding results are possible.

Both cases described are Case Type II, One or Two Indirect Restorations. The primary goal of Case Type II is to match indirect material to adjacent natural dentition. Laboratory communication and the technician's skill are of utmost importance for success. Both cases presented here show restorations that match the adjacent dentition well, and overall final results that are very natural in appearance.

The first is by Sandra M. Cook, AACD Accredited Laboratory Tech-

nician (CMR Dental Laboratory; Idaho Falls, ID). Ms. Cook's case was prepared by Dr. James T. Gavrilos, AACD Accreditation Candidate (Barrington, IL). The treated teeth were the maxillary central incisors. Congratulations to Ms. Cook and Dr. Gavrilos for an excellent case.

The second case is by Rick Sonntag, RDT, AACD Accreditation Candidate (4 Points Dental Design, Inc.; St. Petersburg, FL). The treating dentist was Dr. Leslie A. Barrilleaux, AACD Accreditation Candidate (Scottsboro, AL). The treated teeth were the maxillary lateral incisors. Congratulations to Mr. Sonntag and Dr. Barrilleaux for a very fine case.

If you have not yet taken up the challenge of Accreditation, dare to do it! The rewards are priceless.



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ACCREDITATION CLINICAL CASE REPORT, CASE TYPE II: ONE OR TWO INDIRECT RESTORATIONS



by Sandra M. Cook, CDT
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INTRODUCTION

Advances in dental materials, combined with proven techniques, allow for anterior restorations to blend seamlessly with the natural dentition. Choosing a restorative ceramic material for anterior teeth adjacent to natural teeth is always a challenge. There are many porcelain systems available, both pressed and layered, that can be used to accomplish the same goal. Generally, it is the laboratory technician's knowledge and experience in use of materials that help to determine which restorative system to use. The technician utilizes all the available information to match the restorations to the natural dentition.

It was determined that two all-ceramic restorations would be prescribed to restore this patient's smile.

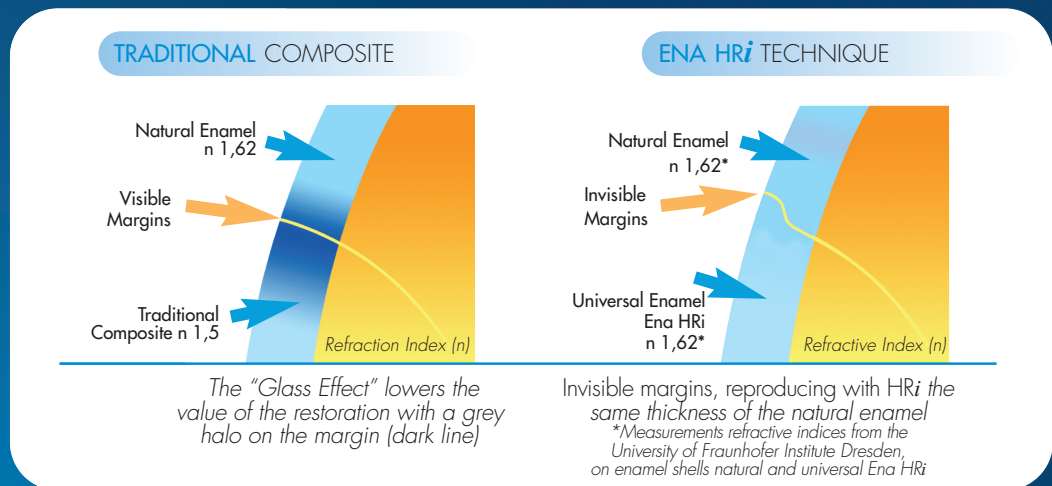
PATIENT HISTORY

The patient, a 17-year-old male, had had root canal therapy on teeth #8 and #9 as a result of a baseball accident (Fig 1). Both central incisors had composite bonding on the facial incisal areas, which had become quite discolored, and a diastema was present. He was self-conscious about his smile and wished to improve upon the color discrepancy. A thorough examination revealed no significant trauma to the tissue, but it was noted that the central incisors did not have the proper length-to-width ratio.¹

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Figure 1: Preoperative full-face view.



Figure 2: Preoperative retracted 2:1 view.



Figure 3: Preoperative smile view.

DIAGNOSIS AND TREATMENT

After the clinical examination and diagnosis by the dentist, it was determined that two all-ceramic restorations would be prescribed to restore this patient's smile. The treatment goals included:

- correcting the color discrepancy
- closing the diastema
- improving symmetry
- improving length-to-width ratio and central dominance
- improving uneven incisal edges

- blending #8 and #9 with the natural adjacent teeth.

Preoperative impressions were received in the laboratory along with all the proper records and photographs. A diagnostic wax-up of #8 and #9 was created to analyze this case. At this point, it is not known just how discolored the underlying tooth color may be, so it is usually up to the dentist to determine how much tooth structure to remove at preparation time. If there is any discoloration, it is preferable to treat it chairside, so that the final result will be more predictable. This prevents

the less predictable step of masking of underlying tooth structure with porcelain (Figs 2 & 3).

Due to the dark color of the endodontically treated teeth, the dentist removed the old composite and internally bleached #8 and #9. Care was taken to seal the coronal aspect of the root canals. The bleaching was done to lighten the existing preparation color.

The patient completed internal bleaching in approximately two weeks. The provisional restorations were made again from the diagnostic wax-up and the case was sent to



Figure 4: Preparations of #8 and #9 after internal bleaching and buildups.

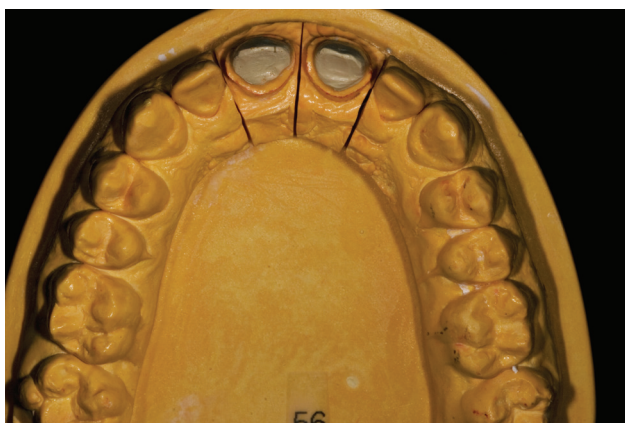


Figure 5: Occlusal view of the model, which demonstrates there is enough room for porcelain.



Figure 6: Model poured up, mounted, trimmed, and ready to begin the crown fabrication process.

the laboratory to fabricate the final restorations (Fig 4).

LABORATORY PROCEDURE

PREPARATION

Stone models were poured, trimmed, and cross-mounted on a Denar articulator (Waterpik; Fort Collins, CO), utilizing all the records provided (Figs 5 & 6).

The dentist indicated on the laboratory prescription that Empress was the desired restorative material; however, the final decision is usually agreed upon after reviewing the

case. Due to the successful internal bleaching of the teeth, Empress Esthetic (Ivoclar Vivadent; Amherst, NY) was indeed selected.

The models were prepared, and wax was applied to the master model using the model of the provisionals as a guide. All the information provided by the dentist was used—including photographs and written instructions—to help determine the final shape and texture of these two teeth and to accomplish the desired goals.²

When the wax-up was complete, the patterns were separated, sprued,

and invested according to the manufacturer's instructions.

SHADE SELECTION

Empress Esthetic ingot EOC-1 was selected for this case, based on the preparation design and color, and the color of the adjacent teeth. The patient was young, and had a rather opaque dentition, without much translucency in the incisal one-third.³ In the photographs, a "bleach" shade tab of OM-3 (Vita 3-D Master, Vident; Brea, CA) was shown next to one of the lateral incisors, and the natural teeth appeared to be more opaque than

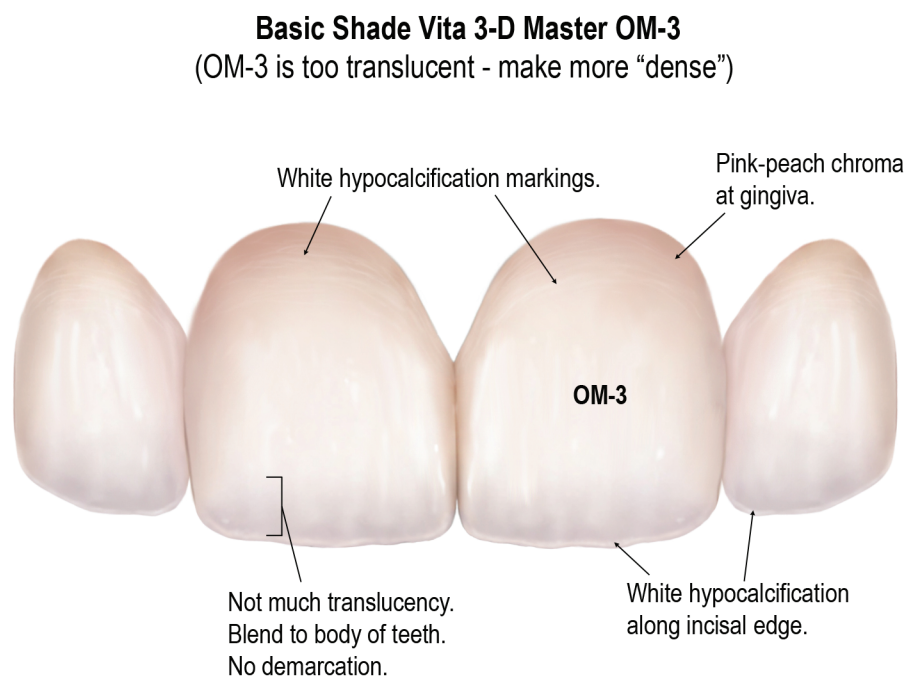


Figure 7: The layers of porcelain that were used in these restorations.

the shade tab. It was necessary to imagine what the pressed thickness of the crown would potentially look like with the preparation color underneath it. The EOC1 ingot is more opaque than the TC ingots from the same system, and seemed to have the correct blend of opacity and translucency to be able to blend with the adjacent teeth.⁴ With a little layering, it seemed that they would match well (Fig 7).

After the restorations were pressed and cooled, they were de-vested and the sprues were cut off. The restorations were then fit back to the master die model (Fig 8).

A clinical photograph showed the preparation shade to be ST-9, so stump dies were made to mimic the color of the preparations (Fig 9).

CONTOURING

The restorations were contoured back to the final shape that had been

determined in the wax-up phase. After completion of this step, an incisal-edge matrix was made using Sil-Tech putty (Ivoclar Vivadent), to index the location, shape, and length of the finalized incisal edge.

Clinical photographs were used as a guide to determine how much of the incisal edge to cut back. Using a diamond-impregnated wheel, only the facial aspect of the incisal edge was cut back due to the low level of translucency that was perceived in the natural teeth. It was necessary to imagine what effects would be "inside" the incisal edge of the adjacent teeth and to mimic that in the cutback (Fig 10).

The restorations were then sand-blasted with aluminum oxide, and steam-cleaned. A small amount of Empress Universal stain and glaze liquid was placed on the internal surfaces, and the restorations were placed on the stump dies. This

served as a wetting agent to evaluate the shade.

In this case, no stain was needed before the interface layer was applied (Empress Esthetic Veneer Wash Paste neutral).⁵ The cut-back shape was all that was necessary to provide the internal effects.

They were then fired in a porcelain furnace at 840° C and allowed to cool.

Empress Esthetic Incisal Opal "low translucent" was then applied to the restorations, and the incisal areas were layered to the full contour, using a fine-tipped brush (Fig 11). They were fired at 840° C, the contour was checked, and a second incisal bake was made using the same porcelain to fill in the deficient areas.

The restorations were then fit back to the master model—making adjustments as necessary—and

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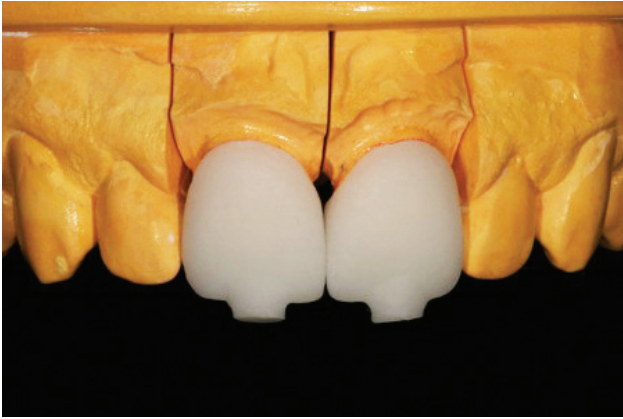


Figure 8: Pressed Empress Esthetic ingots with sprues cut off.

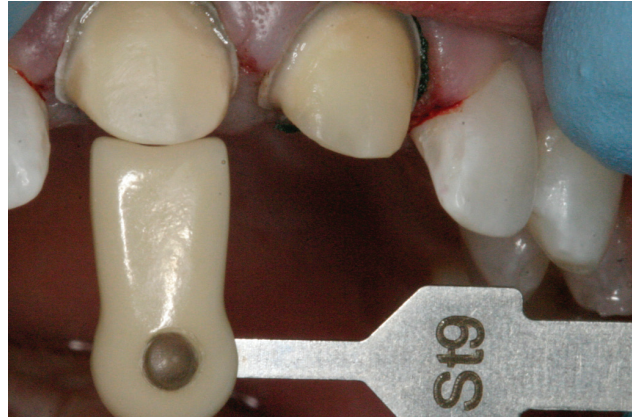


Figure 9: Stump shade of prepared teeth.

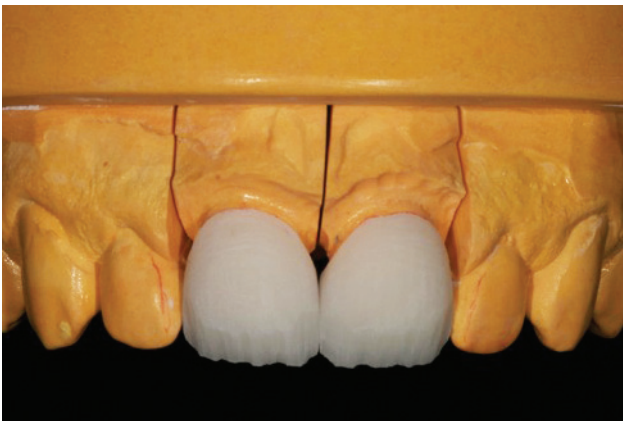


Figure 10: Incisal edge cutback.

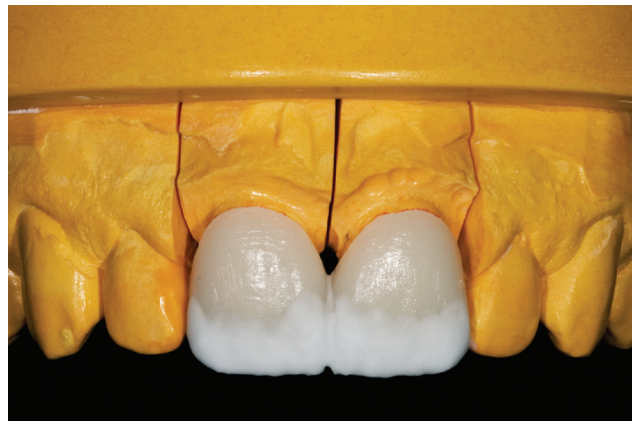


Figure 11: Final layer of porcelain prior to firing to a bisque bake.



Figure 12: The restorations in the bisque bake stage. The primary and secondary anatomy can be critically evaluated at this point without regard to color.



Figure 13: The completed restorations of #8 and #9 are evaluated on the models.



Figure 14: These porcelain restorations should look like "works of art" even before they leave the laboratory.

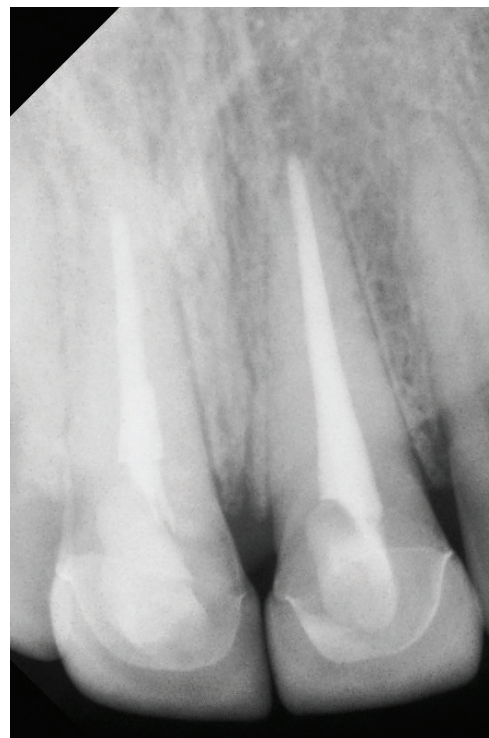


Figure 15: The postoperative x-ray view shows that the margins are properly sealed.



Figure 16: Postoperative occlusal view. Note how the incisal edges follow the arch form.



Figure 17: Postoperative retracted 2:1 view.



Figure 18: Postoperative smile view.



Figure 19: A very happy patient.

making sure the midline was in the correct position.

Various diamond burs and a handpiece were used to contour the incisal back to its original form, checking the surface morphology that was created against the photographs. After some adjustments, the restorations were cleaned and fit to the solid model (Fig 12).

STAINING AND GLAZING

The stain and glaze procedure was performed in several steps:

1. The restorations were placed on the stump dies with the stain and glaze medium and checked for initial color with the shade guide and photographs.
2. Empress Universal shade 110/120 was mixed with a tiny amount of "basic red" (pink) at the gingival to mimic the slight peach color in the photographs.
3. They were fired at 770° C to set the stain.

4. A separate stain bake was made using "white" to mimic the hypo-calcification markings on the gingival and incisal areas.

After the color was deemed satisfactory, a thin layer of Empress Universal glaze was fired at 840° C to seal the surface stain. Upon completion of the final glaze, the contacts were finalized and the restorations were ready for diamond polishing.

The internal surfaces were lightly sand blasted with aluminum oxide, and the facial lobes highlighted with a rubber wheel. They were then diamond-polished with Diashine "fine" polishing paste (VH Technologies; Bellevue, WA) and a bristle brush. This took several attempts of light rubber wheel and polish in order to achieve the desired surface texture that was seen in the photographs. Care was taken not to remove any stain that had been added (Figs 13 & 14).

The restorations were cleaned, dried, etched, rinsed, and dried

again. The case was then ready to be packaged and sent to the dentist's office. After the initial try in and acceptance, the restorations were seated successfully (Figs 15-19).

CONCLUSION

The restoration of this patient's smile was accomplished with pressed porcelain crowns, resulting in improved esthetics. The strength and lifelike attributes of this material blended well with the existing dentition. With the attention to detail and extra efforts taken by the clinician to diagnose, treatment plan, and execute the necessary steps, we were able to help this patient feel more confident. A great working relationship between the dental laboratory technician and the treating dentist is essential to achieving a great functional and cosmetic result. The patient was very grateful for all this effort and thrilled with the result.

Acknowledgment

The author thanks James T. Gavrilos, DDS (Barrington, IL), for his excellence in the clinical aspect of this case. It was a pleasure to work with him.

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Q WHAT WERE YOUR INITIAL CONCERNS FOR THIS CASE?

It is always a challenge to make restorations look real. Ultimately it is the patient who looks in the mirror every morning, so I try to imagine myself in their shoes. I have to be honest...I wasn't really concerned about this case. I knew that the patient was in good hands in terms of the dentistry, so I only had to concentrate on matching the restorations to what existed in the mouth.

Q WHAT WERE THE BIGGEST CHALLENGES?

Making the restorations blend in and look like they belong in the patient's mouth! Making two centrals can sometimes be almost as difficult as making one. But I was lucky on this case...it seemed that a simple pressed restoration with a simple cutback would fit the bill. But I think other than that, the biggest challenges were getting the shape and the length-to-width ratio right.

Q HOW DID YOU WORK WITH THE DENTIST TO OVERCOME THESE CHALLENGES?

I was very fortunate that Dr. Gavrilos took the initiative to address the underlying tooth color, and internally bleach the preparations before I even received the case. It made my job even easier.

Q WHAT IS YOUR OPINION ABOUT THE FINAL RESTORATION?

I think the case turned out well, overall. I am my own worst critic, so I will *always* see things to change. I think if I were to do this case today, I would use a different material... possibly an e.max lithium disilicate low-translucency ingot, and layer it differently. I think I could control the value a little better. Also, lithium disilicate is stronger, so if the patient ever gets hit with another baseball, maybe it wouldn't break! But I think it looks fantastic on the patient, and he seems to be very happy about it—that is the final test!

Q HOW DOES BEING A CDT AND AN AACD ACCREDITED MEMBER IMPROVE A PATIENT'S TREATMENT?

I think that being a CDT as well as being Accredited by the AACD is not just about a few initials to attach to your name, or a plaque to hang on your wall. Both credentials represent years of dedication to a profession that I take very seriously, and that I work on every day at the bench. While I am proud of my accomplishments, I am *more* proud to play a part in a patient's successful treatment and hope that doing my best will in some way help them feel better about themselves, and improve *their* lives. &A

ACCREDITATION CLINICAL CASE REPORT, CASE TYPE II: ONE OR TWO INDIRECT RESTORATIONS



by Rick Sonntag, RDT
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INTRODUCTION

George Bernard Shaw once said, *"The problem with communication...is the illusion that it has been accomplished."* This famous quote rings true every single day, in every single dental laboratory and dental practice in America. Even with the most detailed plans that include all required information, perception of shade on the bench does not always coincide with what we see in the mouth. The following case is an excellent example of how a restorative team can accomplish a world-class result through effective communication.

Even with the most detailed plans that include all required information, perception of shade on the bench does not always coincide with what we see in the mouth.

PATIENT HISTORY

The patient, a teenage female, had undergone orthodontics several years earlier and upon completion, both peg lateral incisors were treated with direct bonding. There was still fixed orthodontic retention in place on the upper and lower anterior teeth. Unhappy with the current condition of the direct bondings, the patient wanted a more esthetic and permanent solution. Her history also revealed good oral hygiene habits, with oral prophylaxis twice per year.

As the patient's senior prom was approaching, it was imperative to provide her with the most esthetic result possible. Discoloration and micro-leakage had brought the bonding to the end of its life span, and with the patient already motivated for improvement, a diagnosis and treatment plan were presented (Figs 1 & 2).

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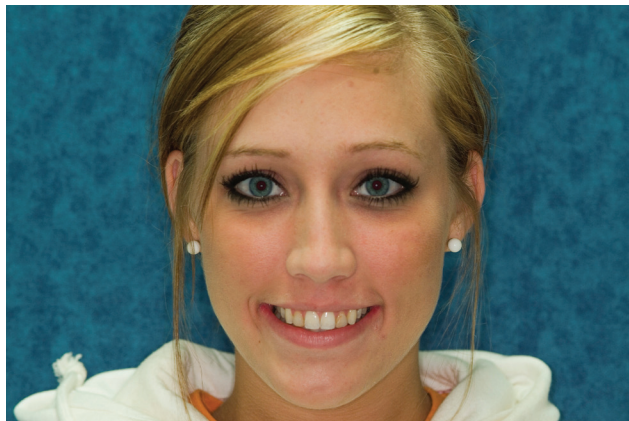


Figure 1: Preoperative view.



Figure 2: Preoperative close-up view showing aging and discolored composites.

DIAGNOSIS AND TREATMENT PLAN

After a comprehensive examination, photographs, and radiographs were completed the patient was found to be periodontally, biologically, and structurally healthy.

In further consultation, the patient and her mother were given the option of either replacing the bonding with new resin bonding or a more permanent solution involving porcelain veneers. They expressed a desire to have the most esthetic result possible, one that would match the surrounding teeth, so a treatment plan was drawn up to place veneers on #7 and #10.

TREATMENT

MATERIALS AND TECHNIQUES

Upon reviewing the preoperative photographs and speaking with the restoring dentist, I was able to present a treatment-planning wax-up that would be used as a preparation guide, as well as the fabrication of the provisional restorations.

After analyzing the photographs, the dentist and I discussed materials and techniques. Several options were available, including layered

feldspathic on refractory models, pressed and layered, and pressed and stained. At this point in a case, the ceramist must decide which technique to use based primarily on the color variations in the natural teeth, and secondarily on his or her comfort level in matching shade and characterization. Input from the restoring dentist is important but the final decision must remain with the person crafting the restorations, the person with the most knowledge of their materials, and the limitations thereof.

At this point in a case, the ceramist must decide which technique to use based primarily on the color variations in the natural teeth, and secondarily on his or her comfort level in matching shade and characterization.

The dentist and I agreed that the ideal material for this particular case would be pressed ceramic, utilizing the staining technique. The patient's natural teeth showed few internal effects and relatively low incisal translucency; in a case such as this, the staining/lustre technique is a simple

and effective way to replicate the surrounding dentition.

MODEL COMPLETION

With the impressions and full set of patient photographs in the laboratory, we were set to begin the model work (Fig 3). Dr. Peter Dawson frequently quotes Dr. L.D. Pankey, saying, "...shoddy model work is not just an indication of poor dentistry...it's absolute proof!" With the models being the foundation of everything we do in the laboratory, it is necessary to ensure that they be clean, free of debris and loose plaster, finely sanded, and have easily accessible pins.

This attention to detail in the model room impacts the case throughout the fabrication process by building quality into the product, a concept at the heart of W. Edwards Deming's total quality management system.¹ Proper mixing of materials influences the fit,² thus affecting the chair time of the dentist at the insertion appointment. The well-managed model also sets the tone within the laboratory in that the technicians working on the case know that attention to detail begins the moment the case comes into the laboratory. For dentist-ceramist teams that

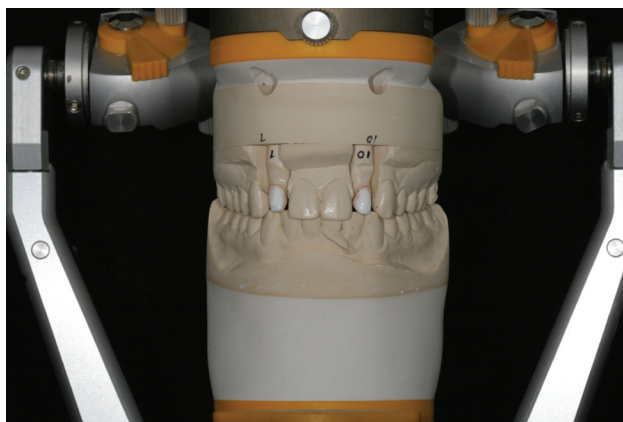


Figure 3. Quality model-work is essential to restorative success. (Models courtesy of Harold Yates; Brandon, FL.)

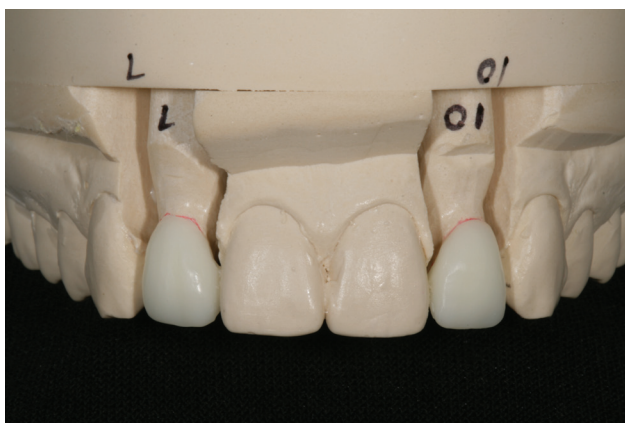


Figure 4: Waxed veneers, shape and length verified and ready for processing.

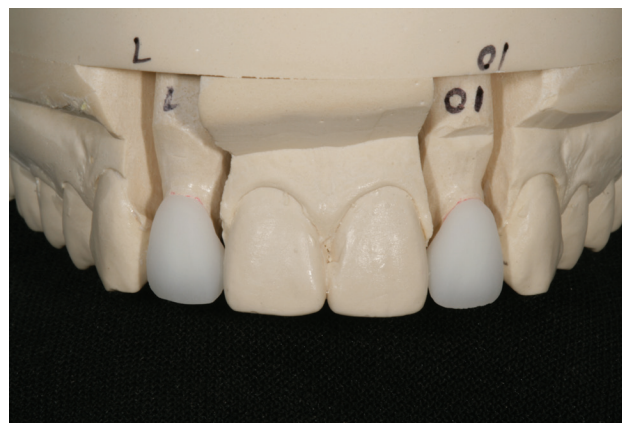


Figure 5: Processed veneers ready for surface finishing and lustre application.

work at a distance from one another, the model is often the only thing a dentist will see from the laboratory, thus turning a few simple chunks of gypsum into a laboratory's "calling card" (i.e., messy models = messy laboratory). In this case, the master model was completed and subsequently mounted to the opposing model using the SAM 3 articulator and facebow system (Great Lakes Orthodontics; Tonawanda, NY), along with photographs of a stick-bite (with interpupillary line) for additional verification of the horizontal plane.

VENEER PREPARATION

With the models in hand and photographs of the prepared teeth including the natural die material (stumpf) shade of the underlying dentin, we were able to proceed with the waxing and processing of the veneers. An incisal edge matrix was made from the approved provisional model using lab putty (GC America; Alsip, IL) and placed on the lower opposing model to determine length, thickness, and positioning of the incisal edge, something that is often overlooked in restorative dentistry.³

Once the waxed form was completed (Fig 4) and the incisal edge of the wax-ups verified, they were sprued, invested, and pressed as per manufacturer's instructions. The veneers were de-vested and seated, ground in to final contour, sandblasted, and given the final surface texture in preparation for the lustre application (Fig 5). At this point the ceramist has a choice to make in terms of the materials used for finishing: the conventional stain technique, which utilizes conventional metal-oxide stains painted onto the surface along with a conventional glaze; or the lustre technique,



Figures 6 & 7: Shade tabs placed end-to-end with the incisal edge of the teeth, rather than in front of or adjacent to surrounding dentition. Placement of the shade tabs is essential in reducing shade variables caused by shadows and varying distances from the lens.

which involves the use of a ceramic paste, thinly applied to the surface of the restoration, combining the ease of staining with the esthetics of layering.

GC Initial Lustre Paste is a three-dimensional ceramic paste developed to create color depth and lifelike translucency with a single paint on application; as opposed to a conventional metal-oxide stain and glaze system, which relies on metal-oxides and traditional glaze. This proprietary formulation not only has an inherent translucency but is also extremely fluorescent, allowing for lifelike replication of natural dentition.³ The system comprises four body shades (Vita A, B, C, and D) which, when applied to the surface of the restoration, allow for the replication of the base shade (chroma) of the surrounding dentition. Incisal effects and characterization are achieved using the nine enamel and effect pastes applied to the incisal one-third. This “paint-by-numbers” system gives the restorative team yet another option with which to achieve esthetic success.

PHOTOGRAPHY FOR LABORATORY COMMUNICATION

It is at this point that quality photography is essential in setting the case up for success. The restoring dentist provided the laboratory with properly exposed photographs so that I could see shade, value, characterizations, and the incisal plane relative to the patient’s lips (the frame) and eyes (the reference) (Figs 6 & 7).^{4,5}

SHADING

GC Initial LF enamel porcelain (E-57) was added to refine the incisal edges so as to provide us with the final form. The first lustre bake was used to establish our base shade with a mix of L-B Lustre Body Shade B) and L-N (Lustre Neutral), with the Natural Die System (Ivoclar Vivadent; Amherst, NY) to replicate the patient’s dentin shade. This was fired at 765°C (15°C lower than the final recommended temperature so as not to overglaze the restorations). A mix of L6 (light blue), L3 (light gray), and L-N (neutral) was added to the incisal one-fourth of the tooth as well as to the mesial and distal lobes to mimic these lower-value/

opalescent areas on the natural teeth.⁶

In preparing for the second lustre bake, a Turbo Stripper diamond bur (NTI, Axis Dental; Coppell, TX) was used at low speed and with minimal pressure to replicate the perikymata so often found in young, vibrant teeth. Once established, a second layer of Lustre LT (neutral) was applied to seal in the base shade and provide a three-dimensionality, as well as a sheen, to the perikymata. A second firing at 770°C was performed. This was followed by the application of InVivo Stain IV 1 White (GC America) and L-1 (Lustre White) to replicate the hypocalcification areas found at the incisal and along the perikymata of the natural teeth, and fired at the final lustre temperature of 780°C. Additional smoothing and surface texture modification was performed using a fine silicone rubber wheel and final polish with diamond paste (Fig 8).

TRY-IN APPOINTMENT

At the try-in visit, dentist and patient noticed that the value was slightly low even with a B 05 try-in paste—a ceramist’s worst nightmare.



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Figure 8: Veneers seated on solid model following final surface texture and lustre adjustment. Final seating on a solid model is essential in reducing the variables and inaccuracies inherent to die models.



Figure 9: Preoperative close-up view.



Figure 10: Postoperative close-up view.



Figure 11: Preoperative full smile.

Was this another well-laid plan gone to waste? Not exactly; the length, form, and characterization matched perfectly, and the accompanying photographs would provide the laboratory with the information necessary to succeed on the second try in. Recovering from a restoration that is too bright is easily accomplished with a little stain, but an overall gray cast almost always requires that the restorations be remade, as was the case here. With new photographs in hand and the confidence of having matched form and characterization, I proceeded with two new veneers one value shade brighter than be-

fore. The laboratory procedure was repeated and the resulting restorations now matched form, function, characterization and, most importantly, value (Figs 9-12).

CONCLUSION

The restoring dentist was able to bond this case with no adjustments to either interproximal areas or incisal edge length due to the use of a solid model for contacts, and an approved provisional model for length and contour. This case was conservative and esthetic, beautiful and simple. But we should look be-

yond the restorations when we decide whether the case was a success. We all remember the insecurities we carried with us in high school; looking in the mirror and seeing brown, chunky, broken-down teeth does little to help the self-esteem of young adults. The real measure of success in restorative dentistry is not just in the teeth we seek to replicate and perfect; it also shines through in the eyes, the "windows to the soul." This young lady can wake up every morning, look in the mirror, smile, and feel good about herself (Fig 13). With the dedication of the restoring dentist, who provided impeccable

photography, detailed instructions, open lines of communication, and a passion for success, this young lady now has a radiant smile and a new-found confidence she can carry, not only to her senior prom but also to bigger and better things during her journey through life.

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Acknowledgments

The author thanks Harold Yates for the outstanding model work; and Dr. Leslie Barrilleaux for her passion, dedication, and commitment to excellence on this case.



Q WHAT WERE YOUR INITIAL CONCERNS ABOUT THIS CASE?

My initial concern was whether we could provide the patient with an acceptable esthetic result given the highly characterized natural teeth, and do so in a timely and efficient manner to have her ready for her senior prom and high school graduation.



Figure 12: Postoperative full smile.



Figure 13: The patient's new radiant and confident smile.

Q WHAT WERE THE BIGGEST CHALLENGES?

Inter-dental space: As can be seen in the preoperative photographs, the patient had very bulky composites closing the space mesio-distally, so I had to find a way to close the proximal contacts while still providing a tooth volume and

dimension that was in harmony with the existing dentition.

Value and opacity control: Her natural teeth were high in value and very translucent through the body of the tooth (as is often seen in young dentition), yet the hypo-calcifications on the incisal third provided a considerable amount of opacity that had to be replicated.

SONNTAG

Choose an ingot too translucent and the lack of light reflection drops the value; choose an ingot too opaque and we lose the necessary depth and three-dimensionality we see in her natural teeth.

Q HOW DID YOU WORK WITH THE DENTIST TO OVERCOME THESE CHALLENGES?

Open lines of communication are critical in working through any esthetically challenging situation, as esthetics are largely subjective ("beauty is in the eye of the beholder"). In other words, you cannot force someone to like something. Upon viewing the photographs and approved provisional model, Dr. Barrilleaux and I, over the course of several phone calls and e-mails, discussed tooth form and maximizing the incisal embrasure space that can define a "youthful" smile, which

would allow us to reduce the perceived width of the veneers. Dr. Barrilleaux had already provided a great foundation with ideal preparations, excellent tissue management, and well-made provisionals; her acceptance of my suggestions in terms of materials and tooth form set us on the path to success.

Q WHAT IS YOUR OPINION ABOUT THE FINAL RESTORATION?

As any ceramist will tell you, there is always something, no matter how small, that one would like to change about a case. In retrospect, I would have spent a little more time narrowing the mesial and distal lobes as well as the incisal edge, to give the illusion of even narrower laterals and refine the perceived length-to-width ratio. All in all, though, I was happy because the

patient was happy and that is one of the most important things.

Q HOW DOES BEING A CDT AND PURSUING AACD ACCREDITATION IMPROVE A PATIENT'S TREATMENT?

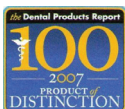
Beginning the AACD Accreditation program or being a CDT or, in my case, an RDT (Canada) shows a dentist and patient that you have satisfied or are attempting to satisfy an academic and practical standard, and have made a commitment to providing the best care possible. The continuing education requirements not only reinforce existing skill levels but also serve to improve techniques, teach new concepts, and inspire the technician to reach for greater heights and become a "knowledge center" and teammate/partner for his or her clients. &

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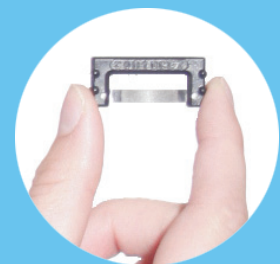


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EXAMINERS' PERSPECTIVES FOR SANDRA M. COOK AND RICK SONNTAG



by Nelson A. Rego, CDT
AACD Accredited Member
Santa Fe Springs, CA
www.regosmiles.com

Case Type II can, in many ways, be the most challenging of the three case types that are required for laboratory technicians to achieve Accreditation. Not only is matching of the natural dentition required, but the dental technician also must take into consideration micro smile design factors that might be out of their control. Are the soft tissue contours and gingival heights conducive to achieving optimal esthetics? Are the preparation shades going to create esthetic challenges? Do the polish, luster, and texture of the restorations match the existing natural dentition? Do the restorations have the correct value, hue, and chroma? The Accreditation Examiners look closely at all these criteria.

The case examination process consists of five examiners using the Criteria Guide to pass or fail a case.

The scoring system is subtractive, with all cases starting at 0 deductions. There are three types of deductions, depending upon the severity of the error and its effect on the case type. For example: A value problem on a Case Type I might not be as glaring an error as a value problem on a single central on Case Type II, which would most likely lead the examiner to give the case a "catastrophic" error (-8) and an automatic fail. If the value problem was not as noticeable, then the examiner might call it a "major" error and deduct 4 points. The slightest of errors would be a "minor" error and result in a deduction of 2 points.

As with all Accreditation cases, case selection is critical! Rick Sonntag's case is a perfect example of good case selection. The patient had old failing composites on teeth

#7 and #10. The gingival zeniths were low and could easily be altered. The preparation shades were light and uniform. Preoperative planning included a wax-up and gingival recontouring, followed by pressed ceramic restorations and an appropriate healing period.

Mr. Sonntag's case passed unanimously with no major faults. Three of the five examiners awarded the case a plus 1. The overall look of the case can award the candidate an additional point, which sometimes can be the difference between passing and failing the case. Scores ranged from minus 2 to minus 5—well below the minus 8, which will cause a case to fail. The most common minor fault noted by examiners was the slight low value between the natural dentition and the ceramic restorations. Other minor deduc-

REGO

tions included the slight asymmetry between #7 and #10, as well as the visible margin on #7.

Sandra Cook's case selection was also ideal. The patient presented with large composites that were failing and discolored. The gingival architecture was good and the oral hygiene was acceptable. While Case Type II calls for either one or two indirect restorations, it is significantly more difficult to fabricate a single central incisor than it is to fabricate two. The fact that both central incisors needed restoring greatly increased Ms. Cook's chance for a successful outcome. As with most successful cases, Ms. Cook also started with a diagnostic wax-up, reduction

guides, and good communication that included digital photography. The preparation shades were a nice uniform light color, which helped to achieve the final result.

Ms. Cook's case was passed unanimously by all five examiners. However, it did have some major faults: Examiners deducted for both the slightly canted midline and the value discrepancies equally, each receiving a minus 4. Examiners' scores ranged from minus 3 to minus 6.

Looking at both Mr. Sonntag's and Ms. Cook's cases, a common theme resonates. Both cases exhibit great planning and communication between the dentist and ceramist. Before the teeth were prepared there was a clear plan that was

meticulously followed; each case was fabricated first in wax, reduction guides that ensured adequate yet minimal reduction and provisional matrices were fabricated and used to create provisionals that were extremely close to the final desired results.

Going through the process of AACD Accreditation is a tremendous learning experience, one that changes the way dentists and technicians look at dentistry. It is said that we learn more from failure than we do from success. However, if you ask Rick Sonntag or Sandra Cook, I am sure they will say that passing isn't too bad either!



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EDITOR'S NOTE:

The National Association of Dental Laboratories and the American Academy of Cosmetic Dentistry partnered to bring you this article, which is being published in each association's journal.

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AN ADVANCED DIAGNOSTIC WAX-UP

by Laura Kelly
AACD Accredited Member

featuring
Juan Olivier, CDT, MDT

Purpose: A diagnostic wax-up can provide a valuable communication tool for dentists, patients, and laboratory technicians prior to treatment. It also serves as a guide for preparation and temporary design, and is utilized as the final restorations are being fabricated at the laboratory. Diagnostic wax-ups can provide the following:

- A three-dimensional, visual communication tool that dentists can use to discuss with the patient regarding the design of their upcoming restorations.
- A communication tool between the laboratory technician and dentist prior to and during treatment, where preparations, case design, esthetics, and patient feedback during the temporary stages are discussed and modified as needed prior to final restorations being completed.
- A guide for reduction and a tool to fabricate temporaries. Patients are able to “test drive” their new smiles and dentists can modify the temporaries, providing additional information to the technician that can enhance the final outcome of the case.

Photography and wax-up provided by LK Dental Studio, www.LKdentalstudio.com (San Ramon, CA).
Featured technician: Juan Olivier, CDT, MDT.



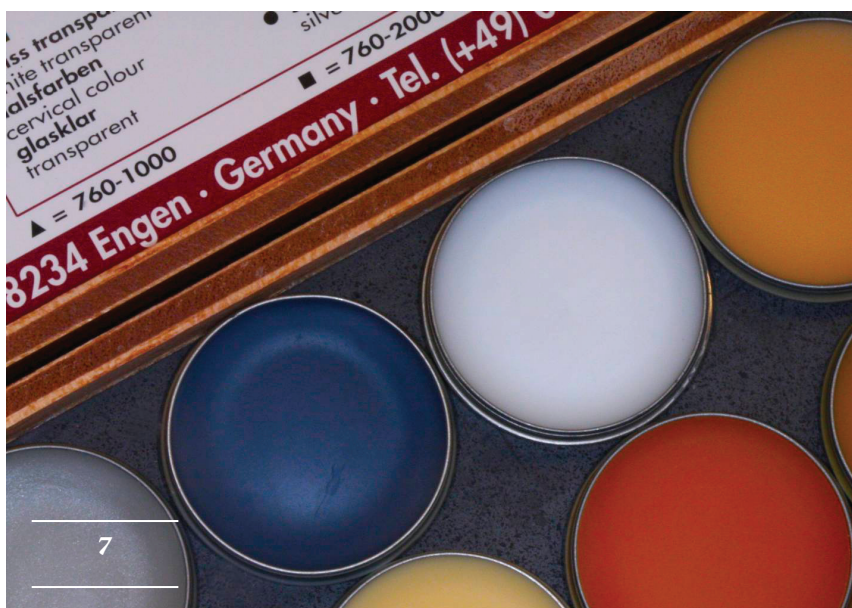
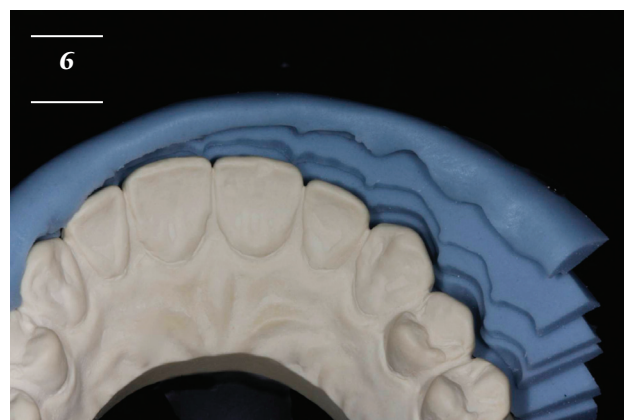
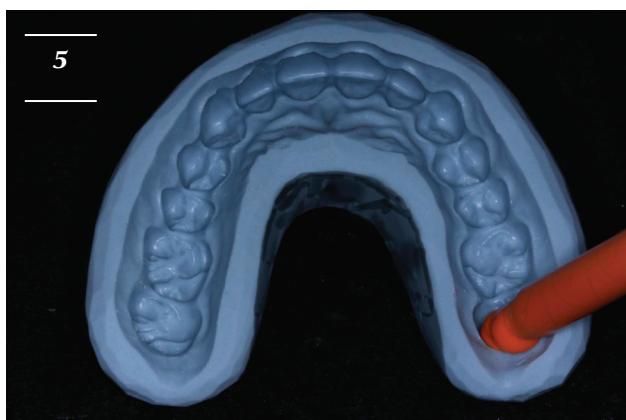
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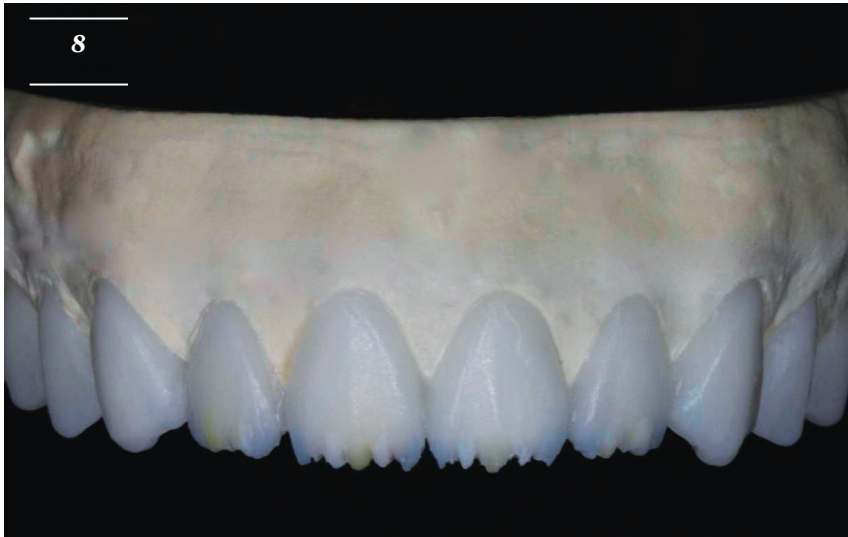
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- 1: Preoperative model with a surgical tissue template. The surgical tissue template is utilized to provide an ideal guide to tissue position height and ideal symmetry for the diagnostic wax-up. The template can transfer to the patient's mouth, providing a guide for the dentist to adjust tissue as needed.
- 2: After the surgical tissue template is created, the new position of the tissue is marked on the preoperative models. Preparation on the model according to the dentist's preferences is begun.
- 3: Surgical tissue template is placed in position over the preparation model, and the model is prepared and ready for diagnostic wax-up.



- 4: Ivory-colored wax is utilized, combined with modifiers and incisal translucency, allowing more realistic esthetics to be provided at the diagnostic stage for dentist and patient to discuss and approve. Ideal golden proportions, function, esthetics, and patient's desires can be discussed at this stage.
- 5: Once the diagnostic wax-up is completed, a Sil-Tech template (Ivoclar Vivadent; Amherst; NY) is created off of the wax-up and is finished with a re-line of a light-body wash to capture additional details of the morphology.
- 6: After duplicating the diagnostic wax-up in stone, a preparation/reduction guide is created. The dentist can use this guide to prepare the case and design for final ceramics.
- 7: Colored wax is utilized to create more natural-looking internal effects and detailed diagnostic wax-up.
- 8: Upon completion of the full-contour diagnostic wax-up, the technician creates an incisal and facial cutback into the ivory wax. Several different wax colors and translucency are applied, imparting a more realistic effect. By adding internal effects, the dentist and patient can discuss their preferences regarding internal effects and degree of translucency. As a result of being provided with a more color-comprehensive diagnostic wax-up, the patient can see a preview of how the future ceramics may look if they desire more natural effects.
- 9: Front view of the completed wax-up.
- 10: Occlusal view of the final diagnostic wax-up, showing detailed morphology and enhanced esthetics created completely with wax.

- 11:** Lingual view of the upper anterior wax-up.
- 12:** Completed full upper and lower advanced diagnostic wax-up.

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RESPONSIBLE ESTHETICS: ESTHETIC CONSIDERATIONS WITHIN THE FRAMEWORK OF THE COMPREHENSIVE DIAGNOSIS AND TREATMENT PLAN



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INTRODUCTION

When patients elect to proceed with treatment to eliminate disease, they assume that the potential benefits of treatment outweigh the risks of avoiding treatment. If complications arise during the course of treating disease—such as the need for endodontic therapy in a compromised tooth restored with a full-coverage restoration—a fully informed patient understands that there are certain risks involved in treating their presenting situation. Complications, though disappointing, are generally accepted by the well-informed patient as a risk of managing their deteriorating situation.

Conversely, when the treatment is deemed to be elective, patients may have more difficulty accepting the risk of complications. When proposing elective treatment to a patient, dentists must communicate the potential complications clearly and honestly and remain firmly in the role of a trusted advisor.

When proposing elective treatment to a patient, dentists must communicate the potential complications clearly and honestly and remain firmly in the role of a trusted advisor.

As healthcare providers in the field of esthetic dentistry, we have several responsibilities when advising patients as they choose the course of treatment that will best serve their long-term interests. First, we have an obligation to evaluate each patient comprehensively. To responsibly establish a diagnosis and develop a treatment plan, esthetic considerations must be balanced with the patient's medical, periodontal, biomechanical, and functional considerations. Esthetic considerations should be presented within the context of health and wellness. Science and sound clinical judgment must be combined when guiding patients to make decisions regarding their care.



Figure 1: The patient was unhappy with the contour, symmetry, and color of the provisional restorations.

Open and clear communication is always important, but particularly when a patient is considering elective treatment. Communication must move in both directions for patients to be fully informed about their treatment options. It is imperative that we have a clear understanding of our patient's concerns, objectives, expectations, and preferences. Additional esthetic concerns should be identified as part of a comprehensive evaluation. As professionals we often have a more complete understanding of the contributing factors that influence esthetics, and it is important to share that information in a careful and tactful manner. However, while doing so, the clinician must take care to avoid encouraging the patient to move beyond satisfying his or her needs. The patient must ultimately decide how much dentistry is appropriate for them. Fully informed patients are best able to make and support decisions regarding their care.

In addition, we have a responsibility to help patients understand the risks—if any—of foregoing treatment, as well as the risks associated with proceeding with treatment.¹ While there is an obligation to ob-

jectively discuss the capabilities and limitations of esthetic dentistry, it is prudent to allow each patient to explore the potential subjective benefits of elective treatment, as they vary widely from one patient to the next.² The subjective benefits for one patient cannot be assumed to be true for the next. It can be misleading to imply otherwise. The skilled clinician must help the patient weigh all evidentiary and non-evidentiary calls to action in order to arrive at the best choice for that individual.³

Fully informed patients are best able to make and support decisions regarding their care.

In the case discussed here, elective treatment was initiated without the patient's full understanding of the risks, capabilities, and limitations of treatment. The importance of the comprehensive examination; the establishment of a firm diagnosis; and the methods used to incorporate the patient's concerns, objectives, expectations, and preferences into the treatment plan are highlighted. The patient ultimately was able to com-

plete treatment as a result of open and careful communication.

INITIAL PRESENTATION: CONCERNS

A 45-year-old female presented to discuss the restoration of her anterior teeth. Her maxillary anterior incisors had been provisionally restored with acrylic restorations. The patient was unhappy with the contour, symmetry, and color of these provisional restorations (Fig 1).

The patient had been under the care of her general dentist for over 10 years. She had undergone orthodontic treatment with removable aligners. At the conclusion of orthodontic treatment in April 2007, she said that spaces remained around the maxillary incisors. The following year, it was recommended that porcelain veneers be used on the maxillary central incisors to widen the teeth and close the remaining spaces. The patient agreed to this treatment. When she arrived for the agreed-upon treatment, the patient pointed out additional spaces distal to the lateral incisors that were of an esthetic concern to her. It was suggested that restoring four teeth instead of two would fully



Figure 2: Three sets of provisional restorations had been fabricated by three different providers over the course of five months.



Figure 3: The patient found the facial contour of the provisional restorations adverse both visually and functionally.

resolve the spacing concerns. The patient agreed to the restoration of four teeth. It was her understanding that the four upper incisors would receive veneers. During the procedure, she became anxious due to the amount of time needed to prepare the teeth. She questioned the dentist and was reassured that everything was going as planned and not to be concerned. During a break in the procedure, she viewed her teeth in a mirror and became distressed about the amount of tooth structure that had been removed. The maxillary anterior teeth had been prepared for full porcelain crowns instead of veneers. Provisional restorations were fabricated and the patient left the office, distraught about the amount of tooth reduction and distinctly unhappy with the appearance of the provisional restorations.

The patient understood that the tooth structure loss was irreversible and began to look for another dentist to restore her teeth. She wanted to feel confident that the clinician had the skill and expertise to meet her esthetic expectations, and, given the miscommunication that had occurred, it was important for her to

find a provider with whom she felt she could communicate effectively.

Over a four-month period, the patient was examined by three additional dentists. A variety of diagnoses and treatment solutions were offered. Some of the treatment recommendations involved the restoration of additional teeth, to which the patient was adamantly opposed. During this time, two additional sets of provisional restorations were fabricated. The patient felt that the new provisional restorations were an improvement over the first set, but she still found them unsatisfactory (Fig 2). At our examination appointment she stated, *"The temporaries stick out in a way my natural teeth never did"* (Fig 3). She also communicated that the maxillary incisors had been sensitive to temperature change since the teeth had been prepared.

The patient stated that, prior to initiating treatment, she had had a reasonably attractive smile. She believed that she had made a mistake in wanting to improve her smile and felt hopeless about any opportunity to regain what she had lost. Even though she despaired about her cur-

rent situation, she was motivated to seek treatment because she knew that the provisional restorations had a limited life span and she risked recurrent decay if she did nothing. After recounting her lengthy dental history, the patient agreed to proceed with a clinical examination and diagnostic records.

DIAGNOSTIC FINDINGS, DIAGNOSIS, RISK ASSESSMENT, AND PROGNOSIS

MEDICAL CONSIDERATIONS

The patient was in good health, with no contraindications to dental treatment.

PERIODONTAL CONSIDERATIONS

The periodontal examination revealed 11 bleeding points upon full-mouth probing, no probing depths greater than 3 mm, and no radiographic bone loss greater than 2 mm. Periodontal risk assessment was determined to be low, with a good long-term prognosis.⁴

STRUCTURAL CONSIDERATIONS

Clinical and radiographic examination revealed multiple direct alloy restorations involving the occlusal



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Figure 4: Structural compromise and active caries were instrumental in establishing a diagnosis of moderate biomechanical risk.



Figure 5: The patient demonstrated a broad smile that revealed maxillary tooth structure and gingival contours from first molar to first molar.



Figure 6: Lips in repose exposed 3 to 4 mm of central incisor tooth structure. The maxillary incisors were determined to be acceptable vertically within the framework of the smile.

and interproximal surfaces of the posterior teeth (Fig 4). Recurrent decay was noted at the disto-occlusal margin of the alloy restoration on tooth #4. The mandibular left first molar had been restored with a gold onlay. The maxillary incisors were provisionally restored with a splinted, full-coverage four-unit acrylic restoration. No teeth had undergone endodontic therapy.

A medium biomechanical risk assessment was established for the existing dentition. A poor long-term prognosis was established unless treatment was sought to definitively restore the anterior teeth and re-

move and restore the active carious lesion.⁵

FUNCTIONAL CONSIDERATIONS

Slight attrition (less than 2 mm) was noted on maxillary and mandibular cuspids and moderate attrition (2 to 3 mm) was noted on the mandibular incisors. As the patient's teeth had been orthodontically repositioned, the exact etiology of the attrition could not be assessed. There was no history or current signs or symptoms of temporomandibular joint and muscle disorder. The temporomandibular joints could be loaded comfortably. The first oc-

clusal contact, with the mandibular condyles positioned in centric relation (CR), was found to be on the posterior teeth. The posterior teeth also contacted in lateral excursions. The functional analysis established a diagnosis of dysfunction. Although the pattern of attrition present on the teeth suggested functional wear, parafunctional habits could not be completely ruled out. The patient was asked during the examination appointment whether she would be open to considering additive procedures to address some of the functional concerns that were being identified. She stated that she would

consider additive techniques that avoided removal of healthy tooth structure.

Functional risk assessment was considered moderate, with a fair prognosis if the current situation was left untreated.

ESTHETIC CONSIDERATIONS

The patient had a high lip line and broad smile, revealing maxillary teeth from first molar to first molar (Fig 5). The maxillary incisors were positioned vertically within the framework of the lips in an acceptable position (Fig 6).⁶ A slightly deficient buccal corridor was noted on the right side. Several microesthetic challenges were documented: unacceptable height-to-width ratio of the maxillary incisors, remaining diastemas, mandibular crowding, asymmetrical tooth shapes and gingival architecture. The dentofacial risk assessment was considered high and the prognosis guarded.

TREATMENT GOALS

The treatment goals for this case were as follows:

- definitively restore the maxillary anterior incisors
- establish acceptable and pleasing height-to-width ratios, horizontal symmetry, and dental anatomic planes of the maxillary anterior teeth, to provide comfortable lip closure
- establish even, bilateral simultaneous occlusal contact of the posterior teeth in harmony with a CR position of the temporomandibular joints⁷
- provide anterior guidance during functional excursions and an acceptable envelope of function that does not prematurely load the teeth⁸

- replace the defective restoration on tooth #4
- respect the patient's wishes to avoid additional removal of healthy tooth structure
- respect the patient's financial limitations
- provide post-orthodontic retention.

PROPOSED TREATMENT PLAN

The proposed treatment plan comprised the following elements:

- consider orthodontic leveling of lower incisors (without additional orthodontic treatment, slight adjustment of the contour of tooth #23 would be required)
- occlusal equilibration
- leveling of the maxillary anterior gingival architecture
- all-porcelain crowns, teeth ##7-10
- porcelain veneers, on teeth #6 and #11, that involved no or minimal preparation of underlying tooth structure
- direct disto-occlusal restoration, tooth #4
- direct composite veneers, teeth #4 and #5
- maxillary occlusal appliance to provide orthodontic retention and protect final restorations.

TREATMENT PHASES

CONSULTATION PHASE

Diagnostic findings, the proposed treatment plan, risks of treatment, and the costs involved with treatment were shared with the patient. She rejected additional orthodontic treatment of the mandibular teeth. While she clearly understood the need to definitively restore the max-

illary incisors, she was unsure about the need for an occlusal equilibration and the suggestion to restore the anterior guidance through restoration of the maxillary cuspids. She was disappointed about the extra costs that these additional procedures added to the treatment plan and left the office without scheduling treatment.

Two weeks later, the patient was called and offered an opportunity to have the provisional restorations replaced at a nominal fee. This would allow her to feel more comfortable with the appearance of her smile while she made an appropriate and unhurried decision about the restoration of her anterior teeth. She stated that she had recently decided to proceed with the treatment plan as it was proposed. She felt that the clinician had respected her concerns regarding the restoration of her teeth and had recommended a treatment plan that supported her best interests. She was ready to schedule accordingly.

PREPARATORY PHASE

The treatment plan was reviewed with the patient prior to beginning treatment. The objectives of the occlusal equilibration were discussed with the patient; she understood occlusal equilibration to be a minimally subtractive technique that would modify the chewing surfaces of the posterior teeth and create even contact of the posterior teeth in harmony with comfortable joints and muscles.

The patient agreed to proceed with treatment, and a full occlusal equilibration was performed.⁹ Direct resin was placed on #11 to help develop anterior guidance. Immediately following the occlusal adjustment, the patient stated that her bite



Figure 7: Pre-existing tooth preparations were evaluated to ascertain structural integrity of the teeth and the relationship of the prepared margins in relationship to the osseous crest. The preparations were not in violation of biologic width.



Figure 8: Preparation guides suggested that only minor adjustments to the existing preparations were required, thus respecting the patient's wishes to avoid further tooth preparation.



Figure 9: When fabricating new provisional restorations for teeth #7-10, thin portions of the provisional material remained on the unprepared cuspids. This allowed the patient to visualize the esthetic advantages of restoring the cuspids, prior to committing to do so.

felt improved. The existing provisional restorations were removed and the tooth positions and preparations were evaluated (Figs 7 & 8). With the aid of preparation guides (Sil-Tech Super, Ivoclar Vivadent; Amherst, NY), it was determined that the tooth preparations were reasonable to achieve the desired result. The only required additional reduction of the previously prepared teeth was the need to refine margin placement and to bevel the incisal tip of tooth #9 to create uniform thickness

for porcelain. New provisional restorations were fabricated utilizing an A1 shade of bis-acryl provisional material (Luxatemp Fluorescence, Zenith DMG; Englewood, NJ). A putty matrix (Sil-Tech) transferred the more symmetrical and anatomic contours that had been developed in the provisional mock-up.

During the fabrication of the provisional restorations for teeth #7-10, thin portions of the provisional material remained on the unprepared cuspids. This allowed

the patient to visualize the esthetic advantages of restoring the cuspids (Fig 9).^{10,11} The patient opined that without the preparation of the teeth, the final contours of the proposed restorations on the cuspids were slightly bulky, and she inquired about the amount of tooth reduction that would be necessary to reduce the contours of the cuspids so the final restoration would be harmonious with the other teeth. It was communicated that .3 mm of reduction would improve the contour and



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Figure 10: The osseous contouring of the crown lengthening procedure on tooth #7 was completed after the provisional restorations had been cemented.



Figure 11: The laboratory mock-up was guided by esthetic, functional, and structural considerations.

allow the facial surface of the preparation to remain in enamel.^{12,13} The incisal edge of tooth #23 was contoured to prevent premature loading on the upper teeth during function.

After the margins of the preparations were refined and greater symmetry of the teeth had been created with the trial provisional restoration on ##7-10, the tissue contours were evaluated. The dentist and the patient agreed that only #7 needed tissue level alteration to achieve the patient's esthetic goal.¹⁴ The facial tissue contour was adjusted on #7 to be more harmonious with the adjacent teeth, the margin was refined, and a new provisional restoration for ##7-10 was fabricated. The provisional restoration was finalized and cemented on ##7-10 with zinc phosphate cement. Hand instrumentation through an intrasulcular incision was used to accomplish the osseous contouring on #7 after the provisional restoration was cemented (Fig 10). Postoperative and home care instructions were reviewed with the patient, and she was dismissed.

LABORATORY COMMUNICATION AND MATERIAL SELECTION

The patient was seen a week later for evaluation of the provisional restorations. She was pleased with the esthetics of her smile and her ability to speak comfortably.¹⁵ She felt hopeful about the possibility of a favorable final result and was anxious to proceed with treatment. Since the patient was happy with the direction of treatment, additional records (a maxillary impression, bite registration, and images) were secured to develop a more refined mock-up that included restoration of the maxillary cuspids.¹⁶ The patient was scheduled for six weeks later.

All records were forwarded to the laboratory with a prescription for a diagnostic mock-up, to include the restoration of teeth ##6-11. The pertinent patient history was included. The laboratory also was informed of the treatment goals to increase the symmetry of the teeth and to limit the preparation depth of #6 and #11 to the enamel layer. Since the incisal edge of the provisional restoration of tooth #8 was suitably positioned vertically within the smile, the laboratory was to use this tooth as a

reference to develop the remaining smile design and functional details. The laboratory mock-up was completed by the technician (Fig 11). A collaborative decision was made by the dentist and the technician to fabricate the definitive restorations using fully layered pressed copings on the incisors (IPS e.max Ceram and e.max Press, Ivoclar Vivadent) and glass-ceramic on the cuspids (d.Sign, Ivoclar Vivadent).

RESTORATIVE PHASE

Following placement of local anesthetic, the provisional restorations were removed from teeth ##7-10. Bis-acryl materials were provisionally added to the cuspids to simulate the final contours of the restorations to aid in minimizing the depth of preparation for #6 and #11.¹⁷ The patient was periodically handed a mirror to verify that only a minimum amount of tooth structure was being removed from the cuspids. The patient assured the clinician that she trusted the clinician's judgment and that it was not necessary to stop the process to reassure her. However, in light of the patient's history, the clinician felt it was important to take



Figure 12: New provisional restorations, which included the maxillary cuspids, allowed the patient to better visualize the final result.



Figure 13: The patient was enthusiastic about the comfort of the lip closure path as established with the provisional restorations.



Figure 14: Remaining asymmetries of the central incisors were noted in the gingival third of the provisional restorations and communicated to the ceramist via photographs.

the time to prevent any avoidable worry during the procedure.

Following a dual cord (Ultrapak #000 and #00, Ultradent Products; South Jordan, UT) packing technique,¹⁸ all prepared teeth were registered with a polyvinyl siloxane impression material (Imprint 3, 3M ESPE; St. Paul, MN). Shade photographs and a bite record of the prepared teeth were secured. A new set of provisional restorations, extending from #6 through #11 was fabricated using a bis-acryl material (Lux-atemp Fluorescence) and secured to

the prepared teeth using zinc phosphate cement on the full crowns and resin cements without adhesive protocols on the cuspids.¹⁹ The occlusion, including functional movements, was refined with the patient in both a reclined and fully upright position. The recommended home care regimen was reviewed with the patient and she was scheduled to return to the office in one week.

Evaluation of the provisional restorations: The patient was pleased with the esthetics, phonetics, comfort, and function

of the provisional restorations (Figs 12 & 13). The clinician confirmed functional harmony. Remaining asymmetries of the central incisors were noted in the gingival third of the provisional restorations (Fig 14). Rather than alter the provisional restorations, it was decided to communicate these minor details to the ceramist through notations made on select photographs of the provisional restorations. An impression and maximum intercuspation bite record were made so that a three-dimensional transfer of information about tooth shapes,



Figure 15: The definitive restorations on the master model highlight the distinct incisal translucency and subtle mamelon effects.



Figure 16: The preparations are isolated and etched with 37% phosphoric acid.



Figure 17: Dentin adhesive was applied liberally to the fully prepared teeth.

contours, and incisal edge position could be easily communicated to the laboratory.

Placement of the definitive restorations: A visual inspection of the restorations was performed upon receipt. All parameters were found to be acceptable (Fig 15).

Following the placement of local anesthetic, the provisional restorations were removed. The preparations were cleaned with 27 μ m aluminous oxide particle abrasion at 40 psi (Prep Start, Danville Materials; San Ramon, CA).²⁰ Each restoration was individually tried in to evaluate marginal integrity and fit.

The restorations were then tried in en masse utilizing a translucent try-in paste (Variolink II Try-In, Ivoclar Vivadent) and the interproximal contacts were evaluated. The patient was positioned in an upright position and both the clinician and the patient reviewed shape, contours, and shade of the restorations. The restorations were found to be in harmony with the shape and contour as designed in the provisional restorations. The shade of the restorations was deemed pleasing. The patient confirmed that she was content with the aspects of the restorations that she was capable of evaluating and

the decision was made to proceed with cementing the restorations.

In preparation for cementation, the restorations were cleaned with 37% phosphoric acid (Etch-37, Bisco, Inc.; Schaumburg, IL) for 60 seconds, rinsed, and dried.²¹ The intaglio surfaces of the restorations were treated with Silane (Clearfil Pocelain Bond Activator, Kuraray Medical Inc.; Okayama, Japan) solution for 60 seconds and then dried thoroughly.²²⁻²⁴

The prepared teeth were isolated from the remainder of the oral cavity with a split rubber dam technique. The teeth were rinsed and dried.



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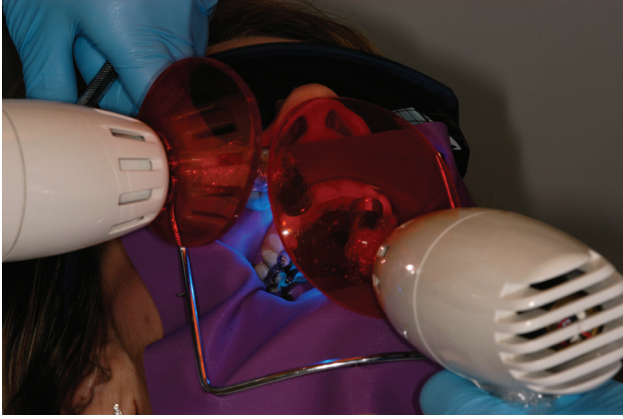


Figure 18: The restorations, filled with light-activated, translucent resin cement, were cured from various angles.



Figure 19: The deficient buccal contour in relationship to the anterior teeth is noted on the maxillary right side.



Figure 20: Direct resin veneers would be used to address the buccal deficiency while respecting the patient's financial considerations.



Figure 21: The physical and optical properties of the nano-hybrid composite allowed for harmonious blending of the direct and indirect restorations.



Figure 22: The patient was distinctly unhappy with the comfort and appearance of the pre-existing provisional restorations.



Figure 23: The definitive restorations served to satisfy the patient's requirements for esthetics, comfort, and function.



Figure 24: The degree of tooth preparation and the appearance of the provisional restorations caused the patient to question the original provider's ability to meet her expectations.



Figure 25: The final restorations should duplicate the incisal edge position, and labial and lingual contours of the approved provisional restorations.

They then were etched with a 37% phosphoric acid solution (Etch-37) agitated for 15 seconds, rinsed, and the excess moisture evacuated (Fig 16). The preparations were blotted with a damp cotton pellet to remove pooling moisture while maintaining a moist surface.

Six applications of a fourth-generation dentin adhesive (All-Bond 2, Bisco, Inc.) were applied to the tooth surfaces (Fig 17). The teeth were gently dried and the appearance of a glossy surface confirmed. Unfilled resin (D/E Resin, Bisco, Inc.) was used to wet the tooth surfaces and the internal surfaces of the restorations. The restorations were coated with translucent light-cured resin cement (Variolink II) and seated on the prepared teeth. Excess cement was gently removed with micro-brushes. Each restoration was cured for 120 seconds from various angles (Fig 18). Excess resin cement was removed with hand instruments. The occlusion and palatal margin of the veneers were adjusted and polished with diamond-impregnated rubber points (Dialite Intra-Oral Porcelain Polishing Kit, Brasseler USA; Savannah, GA).

Direct veneers: At the next visit, the patient stated that the restorations were comfortable and functioned well. The functional and marginal elements of the restorations were examined. A full set of photographs were exposed and reviewed with the patient. The negative buccal corridor on the right side was discussed (Fig 19). It was decided to proceed with placing direct veneers on teeth #4 and #5. The teeth were particle-abraded on the facial surface with 27 μ m aluminous oxide particles at 40 psi. The teeth were treated one at a time. Tooth #4 was etched with 35% phosphoric acid, rinsed, and dried. An unfilled resin was thinly applied to the etched surface and light-cured for 20 seconds. A nano-hybrid composite material (Empress Direct, Ivoclar Vivadent) was placed on the facial aspect to parallel the facial contour of teeth #3 and #6. The material was light-cured for 40 seconds. Tooth #5 was treated in an identical fashion. The gross contours of both composite veneers were subtly sculpted with a fine diamond in an electric hand-piece. A series of impregnated rubber polishing cups (Astropol, Ivoclar

Vivadent) provided a high luster to the restorations (Figs 20 & 21). Impressions were made for a maxillary nighttime appliance.

MAINTENANCE PHASE

The patient was seen for delivery of the maxillary appliance. The fit and occlusal aspects of the appliance were refined. The patient was placed on a six-month recare interval based on the low periodontal risk assessment.

CONCLUSION

This case highlights communication and clinical processes that resulted in an acceptable outcome in the face of a challenging situation (Figs 22 & 23). Open and clear communication is always important but especially so when a patient is considering elective treatment. Informed consent remains paramount to patient satisfaction and the avoidance of unpleasant surprises. Fully informed patients are best able to make and support decisions regarding their care (Figs 24 & 25).

As healthcare providers we have a responsibility to help patients un-

understand the risks—if any—of avoiding treatment, as well as the inherent risks in proceeding with treatment. Patients should be apprised of the reasoning behind all aspects of treatment recommendations, including the degree of tooth preparation that might be required to meet their objectives. There is an established relationship between increasing degrees of tooth reduction and unfavorable sequelae.²⁵ The benefits of increased tooth reduction must outweigh the risks of increased tooth reduction. Patients need to be counseled regarding all the inherent risks associated with treatment, using terminology that they are able to understand. At the end of the day, we must know that we have done our best in guiding our patients to make decisions that serve their long-term needs for health and well-being (Fig 26).

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Figure 26: *Esthetic considerations must be considered within the context of health and wellness. Fully informed patients are best able to make and support decisions regarding their care.*

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LABORATORY PERSPECTIVE FOR RESPONSIBLE ESTHETICS—CLINICAL COVER STORY



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INTRODUCTION

When the author was initially contacted about this case, the dentist said that the patient had been through a lot in her quest to get the smile she wanted.

Teeth ##7-10 had previously been prepared for full-coverage crowns. In discussing the treatment of the four incisors, the only major decision that needed to be made was whether the restorations should be bonded or cemented. The very aggressive preparations allowed selection of any material from porcelain-fused-to-metal to porcelain jacket crowns, although any use of a core-supported restoration would make the case more challenging from an esthetic standpoint.¹

FABRICATION

In restoring the patient to optimal function and esthetics, the cuspids would need to be treated. Fully layered LTB1 e.max Press (Ivoclar Vivadent; Amherst, NY) restorations were chosen to restore the incisors so as to keep both cementable and bonded options open.² The patient's unfavorable experience with the initial treatment of the incisors dictated that the cuspids be treated conservatively. Only two treatment options were considered for the cuspids: feldspathic veneers or directly bonded composite. It was determined that indirect porcelain veneers with minimal preparation would best meet the patient's desires for esthetics and longevity.³

The veneers were fabricated using d.Sign porcelain (Ivoclar Vivadent) with a refractory die technique (Orbit-Vest, GC America; Alsip, IL). The manufacturer's guidelines for firing times and temperatures are a good place to begin evaluation of porcelain maturation. Following the manufacturer's recommended cycles, the e.max ceramic achieved perfect maturation in a Programat P500 furnace (Ivoclar Vivadent), exhibiting an appearance that was somewhat glassy (but not glazed). The extra mass of the refractory dies absorbed some of the heat necessary to fully mature the d.Sign porcelain. The initial two firings of the d.Sign were carried out at a temperature 20 degrees higher than the manufacturer's recommendation for the dentine and enamel porcelains. Subsequent firings were performed at the



Figure 1: As with any procedure, the first step was to produce a diagnostic wax-up of the proposed final arrangement. This "first guess" was transferred to the patient and modified to ideal prior to tooth preparation. By preparing through a modified mock-up, no unnecessary tooth structure was removed.



Figure 2: Note the extremely conservative preparation on tooth #6. The contrast in depth of preparation between the canines and the incisors presented challenges in the restorations blending with one another. If responsible esthetics is our goal, no-prep or lightly prepared teeth should always be our first consideration.

manufacturer's recommended temperature. A diagnostic wax-up was done to allow fabrication of provisional restorations (Fig 1). The provisional was modified intraorally to fit the dentist and the patient's functional and esthetic requirements. The definitive restorations were built into a silicone matrix (Sil-Tech Super, Ivoclar Vivadent) to ensure the exact replication of incisal edge

position and basic two-dimensional form. The dentist provided a basic color map and also requested that the restorations appear natural and lifelike.

DISCUSSION

The patient presented to the dentist having been recently disappointed by the dentistry she had

received. The patient's demands made the most conservative treatment possible, mandatory. Conservative restorative options should be considered whenever possible to ensure minimum tooth destruction and maximum restorative longevity. Preparations for esthetic dentistry are not usually so dissimilar (Fig. 2). This situation generally occurs only when old restorations are removed and additional treatment is done to complete the case. Rather than make all preparations similar, we accepted the challenge of making the veneers blend with the crowns on delivery (Fig 3). Problems can arise with the esthetic integration of dissimilar restorations, owing to their inherently different mechanical and optical properties.⁴

When substrate color is favorable, it is generally considered that a prep-less or lightly prepared feldspathic veneer will give the best chance for a realistic outcome. When crowns are required, the ceramist must first imitate in porcelain the appearance of a lightly prepared tooth before following his or her veneer-layering protocol. Care must be taken to disguise the core, as it is more optically dense than natural dentine and enamel. The I2 paste was used to provide a light absorption zone in the incisal half, to give the illusion of translucency beyond the cutback zone (Fig 4). The fully layered e.max restorations provided an acceptable result, given the clinical condition of the patient's teeth. In the end a combination of excellent dentistry and a happy patient made this case a success.

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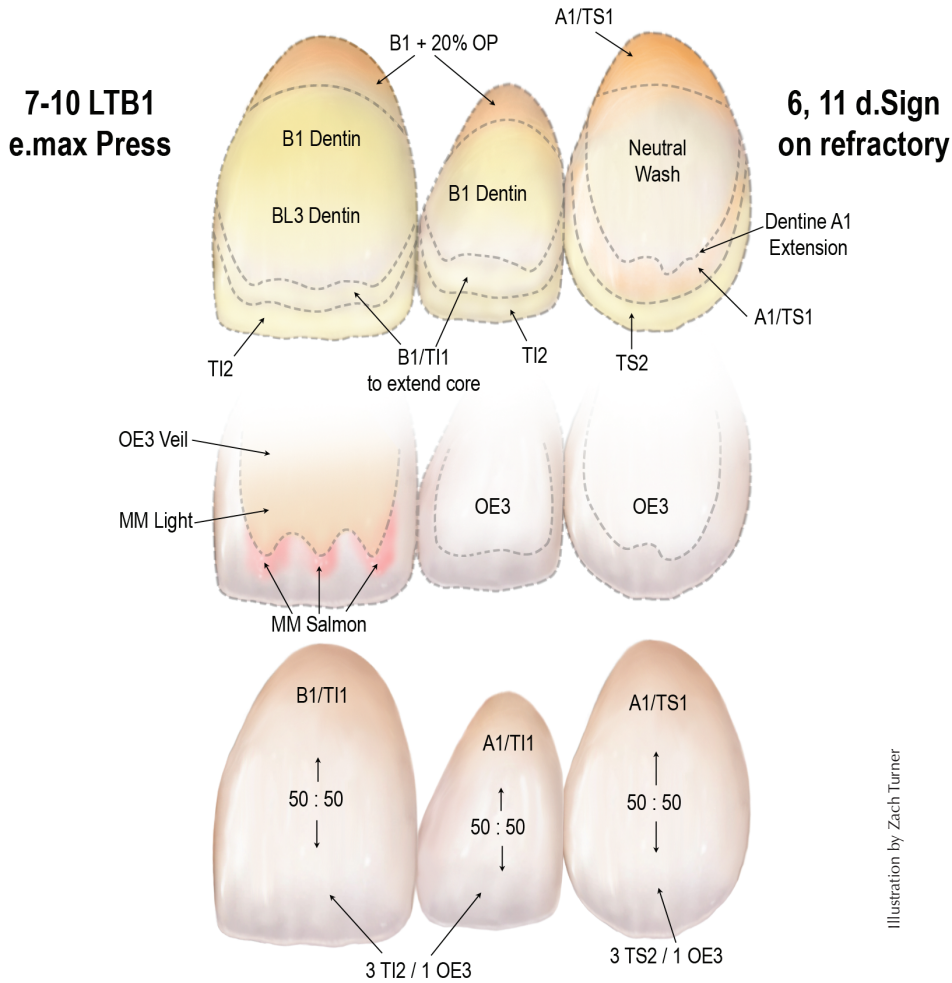


Illustration by Zach Turner

Figure 3: Shade map.



Figure 4: Initial coloring of the pressed e.max restorations was accomplished using the shade pastes. The pastes were fired separately and provided the initial bond between the lithium disilicate and the veneering ceramic.

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DEHYDRATION EFFECTS ON TOOTH SURFACE TEXTURE



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INTRODUCTION

Through years of custom shade-taking experience, it has become increasingly obvious to the author that hydration and dehydration have a significant effect on the perception of how well the final shade and surface texture of restorations match a patient's other teeth. A patient presenting with a dry mouth, or less saliva, tends to display a lack of reflection on the teeth due to the dull appearance of the teeth's texture. A patient with composite bonding and a lack of saliva also will present teeth with a different value, which results in further restorative matching challenges.¹⁻⁴

Through years of custom shade-taking experience, it becomes increasingly obvious that hydration and dehydration have a significant effect on the perception of how well the final shade and surface texture of restorations match a patient's other teeth.

For laboratory technicians to achieve the best possible color and surface texture equivalent to patients' natural teeth, they must know and understand all of the oral environmental conditions that may present. These include a lack of saliva; pink, blue, white, gray, yellow, or brown tones; composite dullness; and low value. Therefore, technicians must consider the influence of direct bonded composites in the mesial-facial and distal-facial contact areas, incisal edge, or even full-facial veneers when attempting to match restorations with the surface texture of adjacent teeth.⁵ The combination of these factors will affect how well the final restoration complements the adjacent teeth in the mouth.



Figure 1: Retracted view of dehydrated teeth.



Figure 2: Once hydrated, the patient's teeth appear shinier, and the color is more intense.

LABORATORY IMPACT

For technicians to visualize the effects of a patient's oral dehydration on the teeth in order to match the dull composite area, a specific technique for obtaining a custom shade can be used. Experience has demonstrated that by asking patients to hold their mouths open in a retracted position for approximately 20 seconds, the appearance of the patients' adjacent teeth and surface texture can be accurately documented.⁶

Because patients generally are not aware of the particular characteristics of their teeth, or what is involved in a custom shade-taking appointment, it is helpful to outline what they will learn by having them look closely at their teeth. Therefore, before initiating the aforementioned procedure, it is important to explain to patients what is being done and why, and to ease their apprehensions while they are sitting in the dental chair.

Technicians must then determine the best approach for rehydrating patients with a dry mouth. They can either moisten the teeth with water or use a glazing liquid in order to

elicit a more vivid color. If the patient's mouth dehydrates within 10 to 20 seconds of opening, technicians should consider one of these options. Without hydration, an intensity dilemma with the adjacent teeth will occur, making it difficult to accurately document the color.

Without hydration, an intensity dilemma with the adjacent teeth will occur, making it difficult to accurately document the color.

Dentists traditionally do not document or describe a patient's dehydration and tooth surface texture. That responsibility lies with laboratory technicians, who must document tooth texture and subsequently perform the proper final glazing procedure when completing the restorations. When restorations are sent to clinicians for cementation and they and their patients notice that something does not look quite right, many times the issue rests with the surface texture.³ Therefore, technicians must carefully consider dehydration and surface texture in their porcelain work to ensure that their restorations are a match.

This article presents three cases in which the patients exhibited tooth surface textures that were very dull in appearance after the dehydration effects took place.¹⁻⁴ As a result, careful consideration of the porcelain build-up and final porcelain application was required.

CASE STUDIES

CASE #1

In a case that represents a perfect example of dehydration and surface dullness (Fig 1), the patient's mouth was retracted for approximately 20 seconds in order to determine surface texture. A photograph was taken after time had elapsed, at which point the lack of color intensity and the subtle value in this color check was documented (Fig 2).⁷ When the patient's teeth were viewed in a hydrated state, the color was better due to the effect saliva has on the intensity of the value. In addition, the surface texture was no longer dull, but had come to life after the moisturizing effect.

The dark after-preparation or prep shade of tooth #10 was exposed after the temporary was removed

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Figure 3: The prep shade was matched with the Simple Enamel and Prep Color Guide.

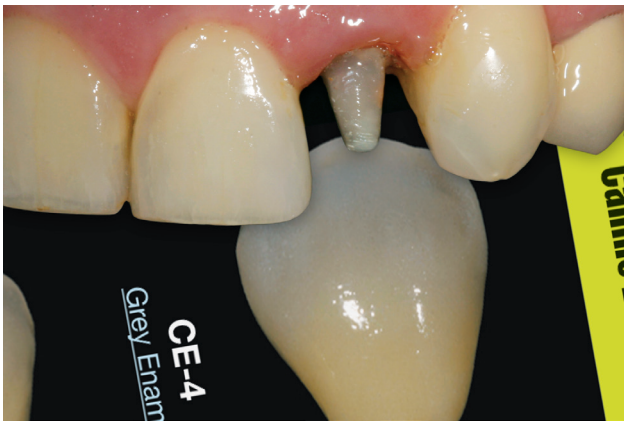


Figure 4: Canine enamel color was checked against the Chair Side Shade Selection Guide.



Figure 5: The mamelon translucency of the two central incisors exhibited a tan color.

(Fig 3). Using a custom-made after-preparation color guide, the technician determined the prep shade to be After-Preparation Color 4 (APC 4).⁶ A common misconception among many dental professionals is that a prep shade is only one shade. However, in this technician's opinion, this is untrue.

When a natural tooth is exposed through preparation, a variety of colors, as well as translucencies, are exposed that are mixed together in a layered effect. This continues through to the center of the tooth, or the prep shade. The prep shade

partially determines the final porcelain build-up application. For example, if a tooth has a post and core, its silver color will appear only in a portion of the tooth and will, if not masked, assert an unwanted influence on the appearance of the final crown. As a result, as technicians layer their porcelain, they could be masking a dark color in one area, but not in another.

Another method of masking dark prep shade is applying composite material directly to the tooth after preparation. However, care should be taken with the preparation de-

sign of the margin area, but composite should eliminate the need to cover a dark prep shade.

Using the *Chair Side Shade Selection Guide* (LSK Oral Prosthetics; Naperville, IL) to check the canine enamel color, the resulting match was found to be CE-4, Grey Enamel (Fig 4). Using the same shade guide, the mamelon color of the two central incisors was also checked and determined to be tan, or MA-2 (Fig 5). Post-cementation and with dehydration, the restoration was displayed in the mouth and then



Figure 6: Post-cementation view with dehydration. The patient's shade matching was verified.



Figure 7: Prior to dehydration, the crown restoration was checked for matching purposes.

prior to dehydration, with saliva (Figs 6 & 7).

CASE #2

A patient who experiences dry mouth can dehydrate in as little as five seconds. Therefore, if a glazing liquid is offered to patients for hydration purposes during the custom shading appointment, they should be advised of the unpleasant taste and informed that it can be rinsed out immediately following the shade-taking procedure. In this case, a zirconia implant abutment was presented in the initial stage, post-surgery, without hydration (Fig 8).

The zirconia coping (GC Milling Center; GC Advanced Technologies; Costa Mesa, CA) was fabricated and placed over the top of the zirconia abutment in preparation for application of the color build-up (Fig 9).⁸ For this case, a computer-generated personal shade-mapping guide using nine different porcelain powder colors was created (Fig 10).

Segmentation of the porcelain build-up is sometimes necessary in the fabrication process because the restoration might require a crack line or mamelon effect only on one section of the tooth. A different

enamel overlay will then be required for that particular area.

In this case, the porcelain build-up was initiated on one-half of the zirconia coping (Fig 11). After the first firing (Fig 12), note was taken of the restoration's contour and, upon examining a side view of the porcelain build-up (Fig 13), the porcelain layering technique was used to create the appearance of layered colors observed in natural teeth, and the restoration was baked (Fig 14). Different enamel layering (GC Initial Porcelain; GC America; Alsip, IL) was applied to create the crack line noted during the custom shading process (Fig 15).

The implant component can be seen alongside the completed porcelain restoration (GC Initial) (Fig 16). Three crowns, each with different surface textures (e.g., dull, rough, and shiny), were created (Fig 17). On the left, the TE1 dull surface was achieved using a rubber polish wheel. The middle crown, TE2, demonstrated the rough, chalky surface of a young person, in the B1-D2 shade zone. The TE3 shiny surface was accomplished using a regular glazing process.

A second set of *Chair Side Shade Selection Guide* surface textures is shown in Figure 18. TE6, or natural, appears narrow between groove and lobe, imparting a three-dimensional appearance. TE5 exhibits a vertical groove only, and TE4 exhibits a subtle wave or ripple effect, similar to when a rock is thrown into a pond.

Within a short period of time, the patient became dehydrated. Fortunately, as a result of effective enamel layering, so too did the appearance of the patient's crown restoration (Fig 19). The implant-supported restoration was cemented and is shown post-cementation, hydrated (Fig 20). The surface textures were a match. The final rest position photograph shows the patient hydrated, with the teeth again exhibiting a glossy appearance (Fig 21).

CASE #3

A young man who was accidentally struck in the mouth with a baseball bat presented for treatment of teeth ##7-11, as well as the gingival areas involved in the incident. Bone grafting and implants were determined to be the only options to save his smile.

KAHNG



Figure 8: View of the zirconia abutment preparation design prior to fabricating the zirconia coping.



Figure 9: View of the zirconia coping.

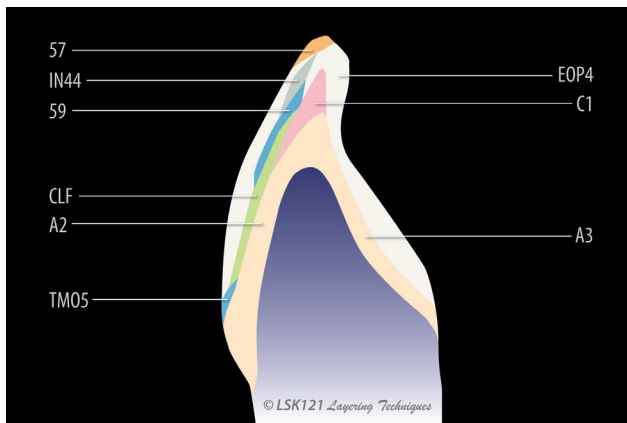


Figure 10: The technician created a computer-generated shade-mapping guide.



Figure 11: The first half of the porcelain build-up was applied to the preparation.



Figure 12: After baking, the appearance of the porcelain was noted.



Figure 13: Side view of the porcelain layering technique.

We all know handling multiple veneers and crowns is tricky.

Dropping one can wreck your case, your day... and maybe even your reputation.



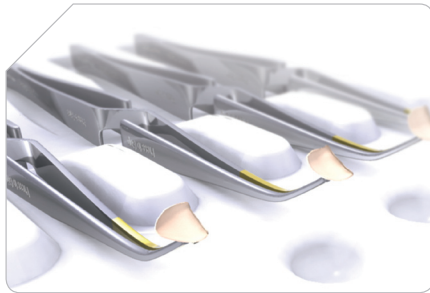
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Griptab Veneer and Crown Delivery System Never drop a veneer or crown again.

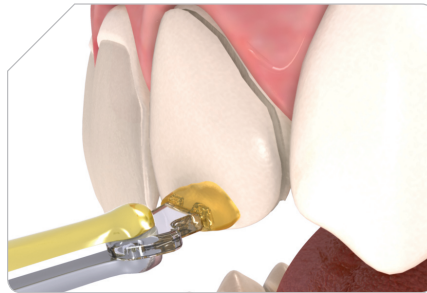
- Griptab is secured to veneer with light-cured adhesive that is 100% Silane and water resistant. Pin-Tweezers ensure complete control through great grip and maneuverability.
- Each restoration has its own Pin-Tweezers, providing a systematic process for etching, silanation, multiple try-ins and cementation.
- The numbered order of placement simplifies and organizes procedure to ensure error-free delivery.
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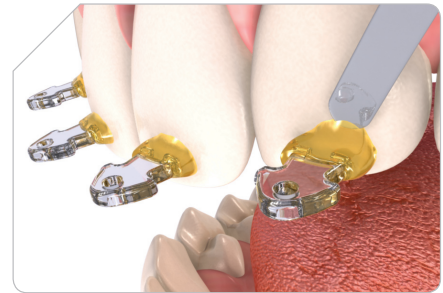
Griptab Veneer and Crown Delivery System Premier shown here



Veneers can be arranged in the disposable veneer tray with the Griptabs arranged in the order of placement – ideal for etching, silanation and bonding.



The unique Pin-Tweezers allow restoration to be picked up and put down multiple times with no stick in the way.



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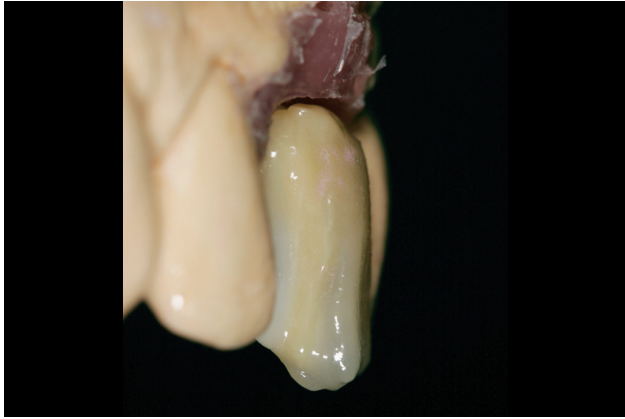


Figure 14: Post-baking view of the different effects that were created using the porcelain layering technique.



Figure 15: The second half of the porcelain build-up created a crack-line.



Figure 16: View of the implant component and final zirconia restoration.

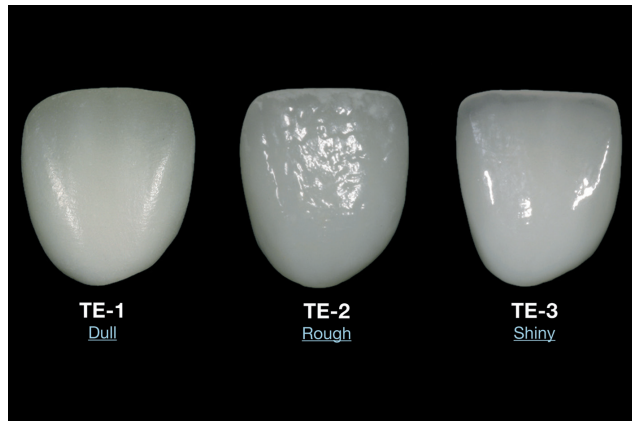


Figure 17: Three crown restorations were fabricated to illustrate different surface textures, such as dull, rough, and shiny.

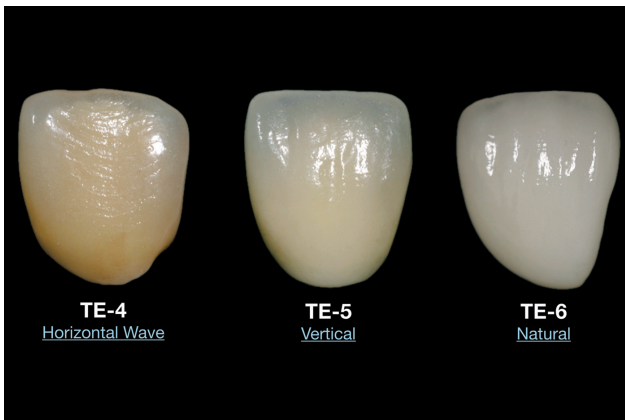


Figure 18: A second set of fabricated zirconia samples demonstrate such surface textures as horizontal waves (TE-4), vertical waves (TE-5), and natural appearance (TE-6).



Figure 19: Image illustrating how patients with dehydration require crowns that exhibit a dull surface texture.



Figure 20: View of the definitive restoration in the mouth, with saliva.



Figure 21: The initial try in of the crowns in the mouth, which were hydrated and glossier in appearance.



Figure 22: During custom shading using a regular shade tab, the patient's unique calcification was not captured.



Figure 23: Using the Simple Enamel and Prep Color Guide, the calcification was clearly noted using the code OE-5.

A traditional shade tab did not identify the patient's decalcification, but only his base shade (Fig 22). However, by using the *Simple Enamel and Prep Color Guide* (LSK Oral Prosthetics) to check calcification and occlusion color, the total effect was captured with a Ridge Only White—OE (Occlusion Enamel) 5 tab (Fig 23).

The demonstration photograph from the guide and the patient's tooth were nearly an exact match. A comparison was made with the Incisal Only (DEC-2) tab from the *Chair Side Shade Selection Guide* in order

to determine the extent of modification required for the case (Fig 24).

As with most young patients, this young man's teeth exhibited a very dull surface texture that was not difficult to match. Hydrated or dehydrated, the surface texture would be the same, making the technician's job much easier to master. After cementation, the patient was very happy with the perfectly blended and beautifully matched restorations (Fig 25). The shape, contour, and harmony of color within the patient's newly made-over smile were noteworthy.⁹

CONCLUSION

An ideal restoration will match patients' adjacent teeth when they are hydrated and dehydrated, which is not easy to accomplish. Although there are many tooth characteristics incorporated into the fabrication of crown restorations—including color and prep shade—if the surface texture is incorrect, all the work put into creating the crown will be futile. Difficulty with matching surface texture is one of the reasons the author produced his own shade guide and enamel color and after-preparation color guide.⁶



Figure 24: For modification purposes, the Chair Side Shade Selection Guide Incisal-Only tab was used for documenting the patient's tooth characteristics.



Figure 25: Post-cementation view of the perfectly blended and harmonious restorations in the mouth.

The patients described in the first two case presentations dehydrated more quickly than most, which made matching the surface textures for their restorations particularly difficult. However, the work was completed successfully because the technician was aware of the side effects caused by dehydration. When faced with similar cases, technicians should ask themselves: How much dehydration does the patient experience, and how quickly? What effect does dehydration have on the color intensity, surface texture, and internal color of the patient's teeth? What appearance do the patient's teeth exhibit the majority of the time?

The patient described in the third case presentation generally exhibited a dull surface texture, which is the type technicians prefer to match.

To achieve an ideal restoration, however, technicians may need to time the patient's dehydration, then match the restoration accordingly.

Acknowledgments

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“DOCTOR, MY VENEER JUST BROKE!” **(HOW AND WHY DOES PORCELAIN FRACTURE?)**



by Alvin Neff, DDS, FAGD
Rogers, AR
www.smileartists.net

INTRODUCTION

Nothing causes my heart to sink more than hearing these words: *“Doctor, my veneer just broke!”* This situation affects us all: the doctor, the laboratory technician, and the patient. This unfortunate event can ruin our day, cost our patients dearly, and even undermine the doctor-patient relationship.

There are many possible causes for porcelain fractures. Some are obviously avoidable and some are unforeseen.

I placed my first porcelain (six maxillary anterior feldspathic) veneers almost 30 years ago. I was especially anxious to do everything flawlessly, as my patient was a local hygienist. My preparations had been minimal, without anesthetic, and no temporization was utilized. As I carefully handled those very thin, fragile-looking restorations, I held my breath, hoping not to break any during the cementation appointment. Happily, the very long, stressful appointment was completed uneventfully. Afterwards, I was concerned that these restorations would not stand the test of time and might be considered “experimental” by my colleagues. Three decades later, this is a routine procedure in most dental offices. Our techniques and materials have been modified from time to time, but our goal of a beautiful, long-lasting smile remains the same. Having placed thousands of units since then, I still think, *“How long will these restorations last, and what can I do to maximize their durability?”*

This article discusses possible causes of porcelain fractures, addresses some treatment-planning considerations, and makes suggestions that could decrease the incidence of this problem.

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Figure 1: Use of computerized occlusal analysis.

ties and durable physical parameters that can perform flawlessly in the hostile oral environment. We should not be surprised that porcelain fractures occasionally occur.

If you have been in practice for a while, you have experienced these problems. Once we hear the dreadful words, "Doctor, my veneer just broke!" we try to analyze the possible causes. As we attempt to answer how and why, we must examine clinician factors, material factors, and patient factors. We often blame ourselves, thinking we failed to design the perfect preparation or establish the proper occlusion; sometimes we point fingers at the laboratory or at material flaws. This leaves out an important part of the puzzle: patient factors.

There are many possible causes for porcelain fractures. Some are obviously avoidable and some are unforeseen.

POSSIBLE CAUSES OF FRACTURES

CLINICIAN FACTORS (IS IT OUR FAULT?)

Some of the more obvious dentist factors are completely within our control:

1. Preparation design accounts for many of our porcelain fracture headaches.¹
 - a. Inadequate occlusal thickness of materials can be blamed for many failed restorations. Proper occlusal reduction will provide adequate occlusal thickness. Lingual reduction of anteriors may only require 1.0 to 1.5 mm of clearance, but posterior clearance must be in the 2.0 range.
 - b. Sharp line angles and rough margins can create internal points of pressure on the intaglio of the porcelain, resulting in damaging internal stresses.
2. Another significant clinician factor is a sound knowledge of

occlusal concepts. It is a given that porcelain performs best under ideal occlusal relationships (near-simultaneous occlusion with evenly distributed forces). All occlusal philosophies agree with this and most even promote some form of anterior guidance lacking in both working and balancing interferences. As both dentists and laboratories try to meet occlusal harmony with restorations, we should consider better ways to measure forces intraorally and determine appropriate treatments. I have found computerized occlusal analysis (T-Scan II, Tekscan; South Boston, MA) to be most helpful in my practice in measuring and correcting possible destructive occlusal forces. This tool measures both the timing and forces of occlusion² (Fig 1).



Figure 2: This veneer was intentionally cooled too quickly to dramatically show this problematic characteristic of porcelain.

MATERIAL FACTORS (MAKE TEETH OUT OF GLASS—ARE WE CRAZY?)

Different types of materials can exhibit differing optical qualities, strength qualities, and technique sensitivity issues.^{3,4} As we focus on the anterior regions, high cosmetic demands are best satisfied with all-ceramic restorations. Three basic categories of materials for these areas are feldspathic porcelain, leucite-based lithium disilicate (pressed or milled), and zirconia-based (pressed or milled) porcelain. We must consider the broad range of sheer strength ranging from 90 MPA in feldspathic to 1000 MPA for zirconia. It makes sense to use feldspathic restorations for prep-less or minimal preparation situations and even more sense to use zirconia in the heavy occlusal force areas. My preference is to select the materials based on the strength requirements. I routinely use feldspathic porcelain where we can keep our restorations thin and supported by large surface areas of enamel. Leucite-based lithium disilicate is my material of choice for restorations that require more thickness and more cantilevered porcelain. Zirconia has also

been used in the anterior region, but I feel it has less desirable optical qualities so I limit its use to full posterior coverage and combination cases.

While porcelain restorations have surpassed our expectations and are ever evolving, we still must consider some inherent problems that can exist within the various materials.

While porcelain restorations have surpassed our expectations and are ever evolving, we still must consider some inherent problems that can exist within the various materials. These hidden land mines are nano-cracks that can propagate undetected until there is ultimate failure. These internal cracks come from three basic material problems:

Vibration of burs that can cause stress fractures. Burs are used in milling machines, reshaping porcelain at the laboratory bench, and reshaping/adjusting intraorally. We can minimize these stress fractures by using coolants, fine-grit diamonds, and electric handpieces.⁵

Bur vibration is gaining much more interest and deserves further consideration.

Cooling of porcelain during the laboratory phases can result in areas of “unhealed” porcelain. This refers to micro-crack propagation that can be exhibited due to the differing coefficients of thermal expansion. Pores, cracks, and inclusions are not uncommon due to large differences in particle size compared to the surrounding glassy matrix.⁶ This mismatch causes different rates of cooling that are difficult to control in multiple firings and the layering process.⁷ This technique-sensitive area is manufacturer-specific and can be limited only by the strictest attention to every detail upon the thermo-cycling of porcelain (Fig 2).

Incisal cutbacks and layering of porcelain on the incisal edge creates natural beauty as well as inherent weakness. This add-on incisal feldspathic porcelain enhances beauty but it is weaker than the core materials of underlying porcelain and can be vulnerable in these unprotected areas. It can also debond completely from differing layers of core materials. It is critical that the

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Figure 3: Incisal cutback failure.

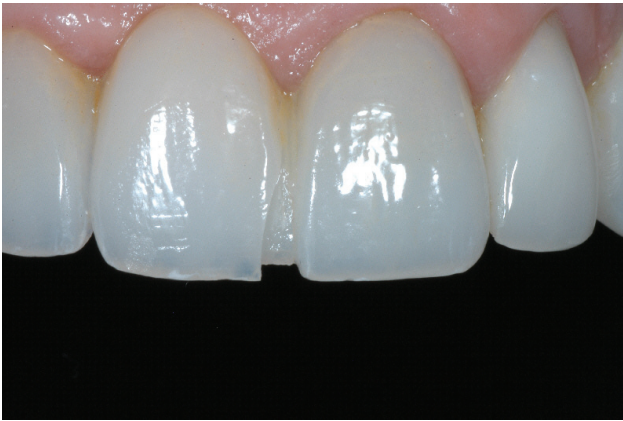


Figure 4: Debonding of differing material layers.



Figure 5: Ultra-thin prep-less veneers; #9 had immediate mesial oblique surface cracks upon cementation.

laboratory minimize the amount of cutback on both leucite-based and zirconia restorations. Studies also support the use of monolithic restorations for posterior occlusal strength. These materials eliminate the multiple layers and weaker interfaces between differing materials (Figs 3 & 4).

Polymerization shrinkage upon light curing of luting agents can also be a factor in porcelain fractures; I think this is primarily of interest in ultra-thin restorations. I personally have replaced a few newly bonded, ultra-thin veneers (0.2 to 0.3 mm) that exhibited small, suspicious-looking lamellae immediately after curing. These areas of concern were unsightly to my patients and I suspect they might eventually fail under stress. Another possible explanation could be stress cracks from seating pressure (Fig 5).

The most unpredictable stressors that every restoration faces are those related to the hostile environment of the oral cavity.

PATIENT FACTORS (IS OUR PORCELAIN ABUSED?)

The most unpredictable stressors that every restoration faces are those related to the hostile environment of the oral cavity. Our restorations are subjected to heavy occlusal forces, parafunctional habits, and occasional trauma⁸ (Figs 6 & 7).

Even the most carefully constructed restorations, placed with meticulous attention to occlusion, can fail due to these damaging forces. Our upper and lower dentition meet approximately 2,000 times per day, with differing amounts of pres-



Figure 6: Blunt trauma, #9 and #10.



Figure 7: Result of crossover parafunctional habits.

sure. Tight clenching can transfer up to 400 MPA of force onto porcelain. These extreme forces can cause tooth flexure, which has been linked to enamel fractures in the gingival facial areas. These abrasive lesions are usually seen in the canine and bicuspid regions. We also see porcelain fractures in these areas for the same reasons.⁹ According to Dr. Gordon Christensen, "It has been estimated that up to 80% of dental patients have aggressive chewing patterns and sometime during their lives about one-third or more of your patients may have overt bruxism and may need an occlusal splint."¹⁰ We should convey this message to our patients and recommend nightguards. I have seen too many patients exhibiting severe wear that could have been minimized by early use of nightguards. When discussing these matters with my new patients, I am surprised that most of them have never been informed of the existing wear and damage to their teeth/restorations.

I believe that nightguards should also be recommended to patients with multiple units of porcelain. This seldom-recommended treatment approach can preserve precious enamel and porcelain. The lit-

erature does not support a decrease in nocturnal bruxism through the use of occlusal appliance therapy; however, a well-constructed full-coverage nightguard can act as a buffer to the occlusal shock and heavy forces that occur during sleeping.

Even with the best clinical techniques, appropriate materials, ideal occlusion, and compliant patients, our restorations will occasionally fail.

Parafunctional habits are also common. We have all seen non-level anterior incisors and anterior notches that can be explained only as a result of crossover and habitual excursive occlusal movements. These movements must be modified with excellent canine-protected occlusion and dominant maxillary central incisors to accept the weight of the mandible without allowing damage to the maxillary incisors. Dr. John Kois vividly describes lateral occlusal patterns in certain individuals, comparing them to the chewing patterns of a cow.¹¹ These lateral chewers exhibit severe horizontal wear and are some of the

most challenging patients to restore. I strive to avoid deepening the overbite in these patients, which may mean restoring lost vertical dimension. It is also important to avoid steep inclines to the anterior dentition.¹² Shallow anterior guidance and flatter posterior occlusion will be the only survivors in "cow-like" chewers. I have these patients sign a pact with me about their nightguard usage, as well.

CONCLUSION

My long-ago concerns about porcelain failure have been resolved. The local hygienist mentioned at the beginning of this article still has the original maxillary anterior veneers intact and she is thrilled with the durability and long-term esthetics. I am even more confident today, thousands of units later, that we can build teeth out of glass and make them last.

Of course we will not be able to prevent all porcelain fractures or even determine the exact cause. We can, however, certainly minimize the risk of its occurrence. We must stop engaging in self-blame, stop pointing fingers at the laboratory, and accept that some of our resto-

rations will be neglected or abused beyond our control. Even with the best clinical techniques, appropriate materials, ideal occlusion, and compliant patients, our restorations will occasionally fail. I have found that most laboratories will offer a two-year warranty on porcelain fracture, and I am happy to offer this same no-fee two-year replacement policy to my patients. By offering some type of verbal warranty, we display confidence in our restorations and establish trust in the doctor-patient relationship.

Our profession is able to delicately balance the fragile properties of glass restorations in these high-stress areas on a daily basis. I commend the members of the AACD for providing spectacular esthetics that can withstand the test of time.

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RECREATING BALANCE, HARMONY, AND SYMMETRY IN THE GINGIVAL COMPLEX IN CONJUNCTION WITH IMMEDIATE IMPLANT PLACEMENT AND RESTORATION



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ABSTRACT

Adequate zones of attached, keratinized tissue are important for the periodontal health of the natural tooth system and surrounding bone. This principle becomes more significant in periodontal/prosthetic and cosmetic dental procedures. Additionally, in tooth replacement procedures, adequate zones of attached, keratinized tissue can lead to a healthy implant/gingival complex. This article discusses acellular dermal tissue grafting in conjunction with dental implant placement prior to the finalization of prosthetic procedures.

...in tooth replacement procedures, adequate zones of attached, keratinized tissue can lead to a healthy implant/gingival complex.

INTRODUCTION

The esthetic enhancement of the natural dentition is a significant component of the contemporary dental practice. Proper zones of attached/keratinized tissue can lead to a balanced, harmonious gingival complex that can complement the ceramic alteration of the natural tooth, or tooth replacement with dental implants. In areas where there is a lack of attached keratinized tissue, in addition to root surface exposure, consideration must be given to correcting the deficient tissue contours prior to any tooth alteration and/or implant placement procedures. Various procedures to correct deficient gingival contours have been well documented in the dental literature.



Figure 1: Pretreatment view, left central incisor.

LITERATURE REVIEW

Increasing zones of attached gingiva using palatal donor tissue and the free gingiva grafting procedure was introduced by Bjorn almost a half century ago.¹ Using palatal donor tissue in the form of a free soft tissue autograft for root-coverage procedures was reported by Miller.² Additional procedures were reported utilizing lateral³ or coronal⁴⁻⁶ repositioning of the adjacent attached gingivae via a pedicle flap, or the coronal repositioning of previous grafted tissue.^{7,8} Miller also reported gingival grafts placed over root surfaces to correct areas of deep-wide gingival recession.⁹ Further surgical advancements led to utilizing subepithelial connective tissue from the palate to obtain root coverage.^{10,11}

One of the impediments to patients accepting soft tissue procedures to correct gingival loss is the trauma from harvesting palatal donor tissue. Depending upon the volume of tissue required to correct the recession present, multiple harvesting procedures may be required. Also, an inadequate amount of connective tissue may be present, and the patient's medical status may play a role in whether he or she is a good

candidate for the palatal donor site surgery. As a result of some of these concerns, corrective gingival surgery expanded to the use of acellular dermal matrix (ACDM) grafts as a substitute for palatal connective tissue grafts.¹² Harris reported a comparative study of root coverage obtained with an ACDM versus a connective tissue graft.¹³ He observed no clinical or statistical difference between the two materials. Henderson and colleagues reported on predictable multiple-site root coverage using an ACDM autograft,¹⁴ with additional clinical documentation of dermal matrix grafts and their successful use in root-coverage procedures.¹⁵⁻¹⁹ Allen described a tunneling technique whereby a surgical pouch is created, the ACDM is placed into the pouch, and the pouch is then coronally repositioned to cover the graft completely.²⁰

When required, pre-prosthetic gingival surgery can enhance the final result in reconstructive and cosmetic dentistry.

Obvious advantages exist in utilizing ACDM grafts. The avoidance of harvesting the palatal tissues is a

major benefit to patients undergoing this type of treatment. For the surgeon, to have unlimited amounts of tissue available, and to be able to treat multiple teeth sites at one visit, makes the surgical procedure more efficient and less traumatic. Additionally, a high quality of the donor tissue, in addition to its natural esthetic appearance, and patients' improved acceptance of therapy, makes this tissue an ideal replacement procedure for palatal soft tissue grafting.

As dentistry continues to expand into the esthetic realm, whether by enhancement of the natural tooth, or replacement of the tooth system with dental implants, the soft tissue contours established and maintained play a major role in the success of the reconstruction and/or cosmetic procedure. When required, pre-prosthetic gingival surgery can enhance the final result in reconstructive and cosmetic dentistry. As the popularity of dental implants as a tooth replacement option continues, especially in the esthetic zone, the necessity of a thick biotype of soft tissue,²¹ in addition to attached keratinized gingivae,²² is important to increase the predictability of the



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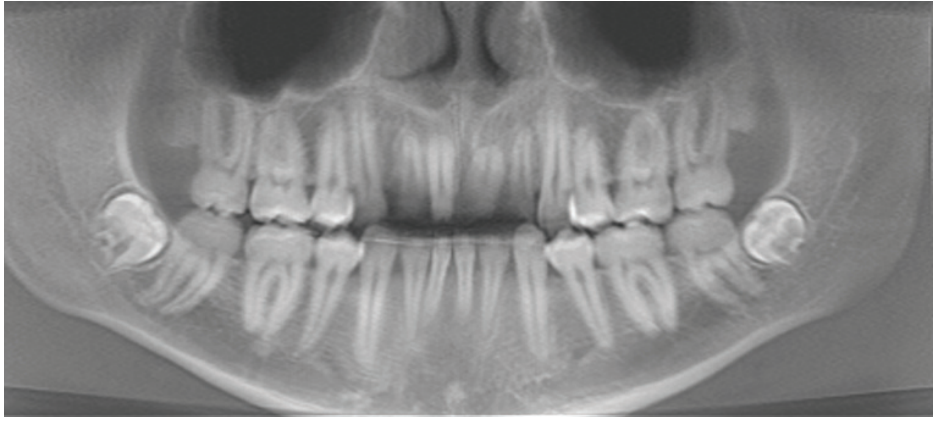


Figure 2: Pretreatment panoramic radiograph.

procedure. Additionally, incorporating prosthetic principles at the time of surgery can enhance the esthetic aspect of the procedure by utilizing those principles to sculpt and guide tissue contours.²³⁻²⁷

The following clinical case discusses the use of ACDM grafts around natural teeth, and dental implants, to augment insufficient gingival contours.

CASE REPORT

A 24-year-old, non-smoking male presented for treatment of a horizontally fractured left central incisor (Figs 1 & 2). The patient had requested an implant to replace the left central incisor so as not to incur any damage to the adjacent dentition.

Complicating the treatment site was the apically positioned facial height of contour at the left central incisor and adjacent left lateral incisor (Fig 1). Additional sites of recession were present throughout the oral cavity; these would be addressed by the tunnel grafting procedure previously outlined.

TREATMENT OPTIONS

Treatment options for this case were as follows:

- Tooth removal, ridge preservation, healing phase, implant placement, healing phase, abutment connection (removable partial denture at provisional).
- Tooth removal, implant placement, bone grafting (non-immediate provisional technique) utilizing a removable partial denture as provisional, healing phase, then Stage II.
- Tooth removal, implant placement, bone grafting, abutment connection and immediate provisional restoration, with simultaneous soft tissue augmentation with dermal matrix tissue and the tunnel graft procedure, all by minimally invasive means.

After review, the patient selected the third option.

TREATMENT

After administration of an appropriate local anesthetic, a frenectomy was performed utilizing an Nd:Yag

laser (Fig 3). This would allow for the loosening of the facial tissues and the coronal repositioning of the pouch at the termination of the procedure. Following the frenectomy the left central incisor was removed by an atraumatic technique, preserving the soft tissue emergence profile (Fig 4). Debridement of the extraction socket preceded atraumatic site preparation techniques. A 3.5-mm diameter by 13-mm tapered implant (Prima Connect, Keystone Dental; Burlington, MA) was placed to the appropriate depth measurements planned.^{26,27}

Following the frenectomy the left central incisor was removed by an atraumatic technique, preserving the soft tissue emergence profile.

Once the implant was seated, the cover screw was placed, and the facial defect present at the buccal aspect of the implant was corrected utilizing mineralized, large particle cancellous chips (Lifenet; Virginia Beach, VA) and a solution of plate-



Figure 3: Laser frenectomy, left lateral view.



Figure 4: Atraumatic extraction, left central incisor.

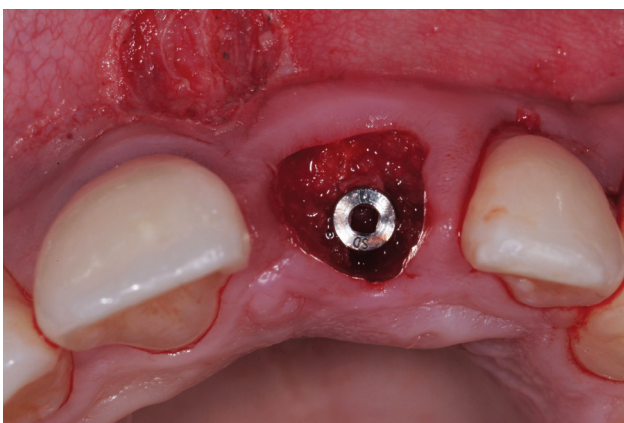


Figure 5: Minimally invasive bone grafting, after implant placement.

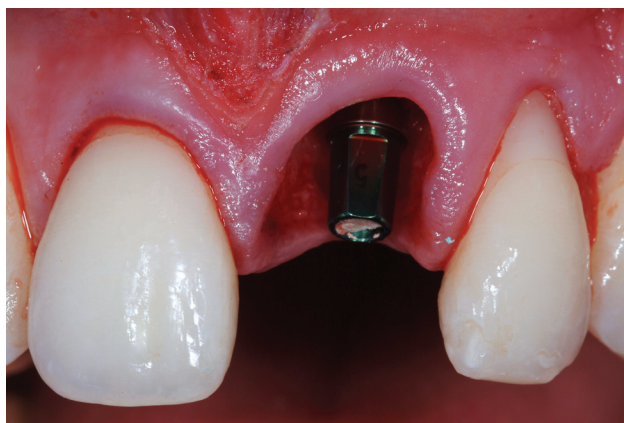


Figure 6: Titanium abutment seated.



Figure 7: Retrofitted natural tooth shell.



Figure 8: Immediate provisional restoration.



Figure 9: ACDM placed into "pouch."



Figure 10: Pouch coronally advanced over dermal matrix graft.



Figure 11: One-week postoperative clinical view.

let rich plasma (PRP), forming a graft/prp gel complex. The graft complex was heavily condensed into the void present, to the level of the facial aspect of the polished collar on the implant (Fig 5).

Following placement of the graft complex, a titanium abutment with a 1-mm collar (Quick abutment, Keystone Dental) was seated and hand-tightened (Fig 6). Retrofitting of the natural tooth shell preserving the pre-existing contact point relationships and line angle positioning was accomplished from a pretreatment incisal edge registration. The retrofitted natural tooth shell is shown in Figure 7, and the immediate post-surgical clinical view prior to soft tissue enhancement can be seen in Figure 8.

Creation of the facial pouch was accomplished by surgical techniques reviewed earlier. Intra-sulcular incisions were made from the distal line angle of the right central incision to the distal line angle of the left canine, with care given to not totally incise the papillae at the interproximal aspect. Using muco-periosteal elevators and blunt dissection, the pouch was extended apically beyond the muco-gingival junction, and laterally to the facial aspect of the tunneled papillae. The pouch was then deepened and mobilized by sharp supra-periosteal dissection. The pre-trimmed dermis (AlloDerm, Biohorizons, Inc.; Birmingham, AL), rehydrated with non-activated PRP, was placed into the pouch, superior to the allogenic bone graft placed to correct the facial defect at the implant site, from the mesial of the right central to the mesial of the left canine (Fig 9). The dermal matrix was secured with a 6.0 polypropylene suture, and the pouch coronally advanced to cover the dermal matrix graft completely, using a 5.0 Monocryl (Ethicon; Somerville, NJ) suture with an interrupted sling-suturing technique (Fig 10).

The provisional restoration was an immediate non-functional restoration, and was free of contact in centric occlusion,



Figure 12: Pretreatment view, left canine and lateral incisor.



Figure 13: ACDM placed into "pouch" around natural teeth.



Figure 14: "Pouch" coronally repositioned over dermal matrix graft.



Figure 15: Three months post-treatment, right lateral view.

protrusive, and right and left lateral excursive movements.

POSTOPERATIVE

A one-week postoperative view can be seen in Figure 11. Please note the free gingival margin at the mid-facial point of the left central incisor, and compare that to the pretreatment level seen in Figure 1.

At this time, the correction of the gingival deficiencies at the maxillary right canine and lateral incisor was accomplished. The pretreatment clinical view can be seen in Figure 12. Following the surgical procedure to create the "pouch" earlier de-

scribed, the dermal matrix graft was inserted sub-epithelially into the pouch, and secured with a 6.0 polypropylene suture (Fig 13). This was followed by coronally repositioning the "pouch" over the dermal matrix graft previously inserted, with 6.0 polypropylene sutures using an interrupted "mattressing" technique (Fig 14).

The three-month postoperative view of the maxillary right canine and lateral incisor is shown in Figure 15. Please note the root coverage obtained, along with the zone of keratinized tissue present.

At this time, the restorative procedures were initiated at the left central incisor implant site (Fig 16). After removal of the retrofitted natural tooth crown (Fig 17), the stock titanium abutment can be seen within the soft tissue emergence profile obtained by the immediate restoration procedure performed (Figs 17 & 18). After insertion of an appropriate transfer coping assembly, registration of the fixture level and tissue emergence profile present were obtained by routine impression methods, along with appropriate bite registrations.



Figure 16: Three months post-treatment, maxillary left central incisor.



Figure 17: Three-month post-treatment soft tissue emergence profile, provisional abutment seated.



Figure 18: Three-month post-treatment soft tissue emergence profile.

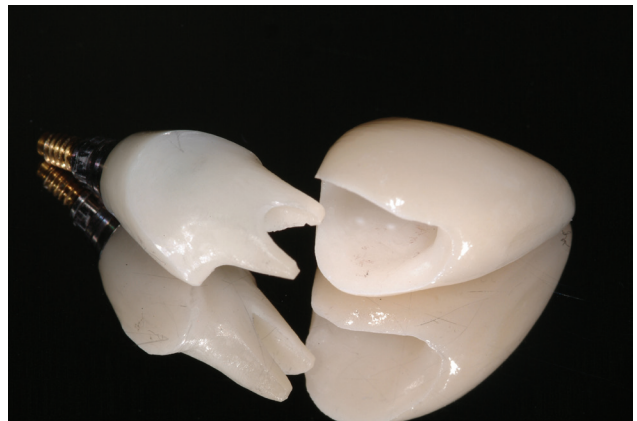


Figure 19: Custom-milled Lava abutment and all-ceramic final restoration.



Figure 20: Custom-milled Lava abutment seated clinically.



Figure 21: Final provisional restoration seated four months post-surgically.

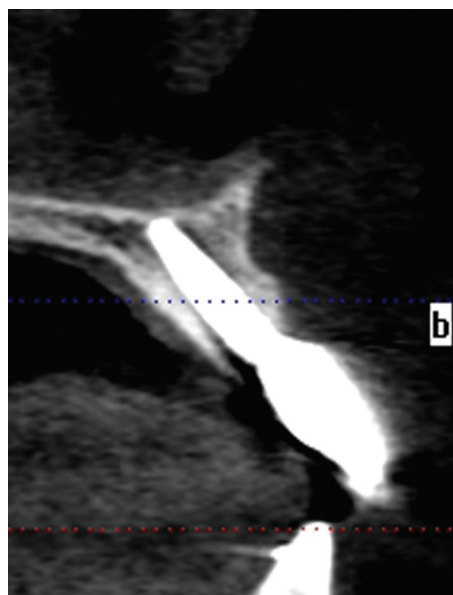


Figure 22: Case-complete cone beam image, serial view.

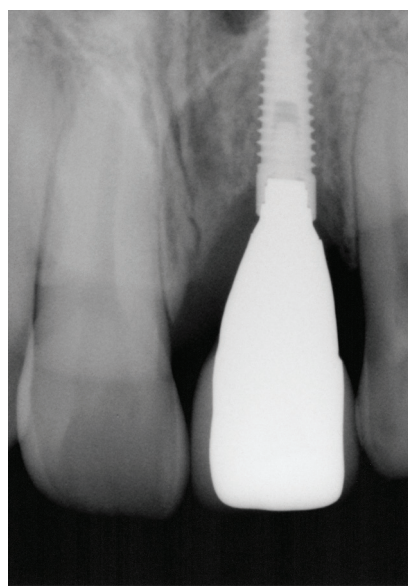


Figure 23: Case-complete periapical radiograph, left central incisor.

The custom-milled Lava (3M; St. Paul, MN) abutment and all-ceramic restoration are shown in Figure 19, with the custom-milled Lava abutment seated intraorally in Figure 20. Please note the contoured abutment, and how it sits spatially within the sculpted soft tissue emergence profiles obtained. The final provisional is seen in Figure 21, seated with provisional cement, four months after implant placement. Minor shading issues, along with line angle and cervical contours, will need to be corrected, but please observe the excellent soft tissue interproximal contours maintained, and the repositioning of the facial gingival tissues in the coronal aspect when compared to that shown in Figure 1. The case-complete cone beam image, serial view, is shown in Figure 22; the case-complete digital periapical radiograph is shown in Figure 23.

CONCLUSION

Adequate zones of keratinized, attached tissue are important for long-term periodontal health and maintenance. Restorative and/or cosmetic dental procedures benefit from having this type of periodontal environment. Soft tissue grafting and augmentation procedures have been developed and perfected over the last 30 years, and incorporation of ACDM grafts have simplified the procedure and made it more patient-friendly, allowing patients who have avoided the palatal donor harvesting procedure to have the procedure accomplished by using a safe and effective biomaterial.

Acellular dermal matrix tissue has proven up to the task for palatal connective tissue for root-coverage procedures in randomized, controlled clinical studies.^{12,16-19} Tal and colleagues reported that the use of AlloDerm, under a coro-

nally advanced flap, produces an esthetic outcome superior to that achieved with a palatal connective tissue graft.¹⁸

Dermal matrix grafting possesses distinct advantages over palatal connective tissue because:

- the palatal donor surgical site can be avoided
- multiple teeth can be treated at one visit
- unlimited amounts of donor tissue are available
- the donor tissue is of high quality
- there is the ability to match, or be superior to, the results observed with autogenous palatal tissue grafts.

Reestablishing the proper soft tissue quality prior to restorative intervention contributes to more predictable outcomes for tooth enhancement and replacement proce-

dures. Incorporating multiple procedures, although technique-sensitive, can decrease surgical trauma, allow for less soft tissue shrinkage and recession, and can simplify the entire tooth replacement procedure, while allowing for the regenerated bone and soft tissue to heal and mature over the same time frame. This, in turn, can enhance the tooth replacement procedure.

Acknowledgments

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INTRODUCTION

There has been a significant increase in the communication opportunities between the dentist and the dental technician. Thanks to technological advances such as digital photography and imaging, e-mail, texting, and file sharing, an entire new dimension of communication is emerging, making even the most comprehensive cases more predictable. This article details communications between a dentist, clinical team, and laboratory technician to facilitate the creation of one such patient's smile.

An entire new dimension of communication is emerging, making even the most comprehensive cases more predictable.

PATIENT INFORMATION

The wife of a retired physical therapist (who was known as the best in his region for the treatment of temporomandibular pain) sought all the function that her husband knew was important, while also wanting a beautiful smile. The patient's desire was to have a new smile with straight, noticeably white teeth. She presented with anterior crowding and misaligned teeth; #6 and #9 were the most affected. The extent beyond the desired arch form of #6 and #9 and lack of fill of the buccal corridor necessitated orthodontic movement (Figs 1a-1c).



Figure 1a



Figure 1b



Figure 1c

Figures 1a-1c: Diagnostic photographs made at initial comprehensive oral examination, including the profile view to assess the incisal edge position of the central incisors.

DIAGNOSTICS AND TREATMENT PLAN

Initially, Invisalign orthodontia (Align Technology; San Jose, CA)¹ was used, allowing for improved emergence profile. The goals of orthodontia included the following:

1. Correcting the more severe alignment issues of #6 and #9.
2. Reclining the maxillary incisal edge position 1 mm.
3. Aligning the teeth to allow for completion with restorative dentistry.

Orthodontia was completed in seven months. Occlusal equilibration was performed and new diagnostic records were made, including facebow^{2,3} (Fig 2), bite registration, diagnostic photographs (Fig 3), and models.

Preoperative photographs revealed the mismatched crowns, large teeth, and previous large restorations, warranting crowns and veneers that wrap into most interproximal surfaces (Figs 4a & 4b). The patient's fair skin, blue eyes,

and blonde hair allowed us to use the Chromascop BL1(010) shade (Ivoclar Vivadent; Amherst, NY) that she wanted.

The treatment plan was to wax up and restore with porcelain laminates at #6, #7, #8, and #10; and all-ceramic crowns at #4, #5, #9, #11, #12, and #13. We will restore #14 and #15 at a later date, to allow for a solid posterior stop during the fabrication of ##4-13.

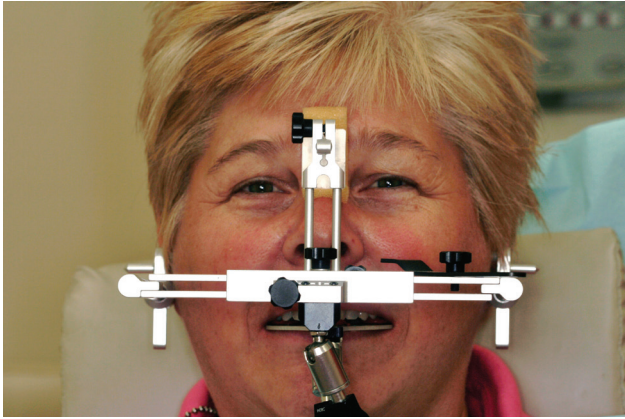


Figure 2: The facebow was leveled vertically and then horizontally by way of adjustments at the ear piece. Then it was photographed in the patient's mouth to relay the accuracy to the technician.



Figure 3: New diagnostic photographs made after the orthodontia was complete for the diagnostic wax-up.



Figures 4a & 4b: Pretreatment photographs made prior to Invisalign; 1:2 (1:3) magnification retracted and occlusal views.

PRE-FABRICATION COMMUNICATION

The dentist communicated the diagnostic wax-up desired on a computer-generated prescription (Fig 5). This form was created to convey the information necessary for complex cases. The content of the prescription was initiated by the chairside assistant, detailed by the dentist, and printed to go into the lab case for shipment. Having the prescription computer-generated made it legible and easily reviewed or modified upon conversation with the laboratory technician. In the event that modifications were made during a discussion over the phone or via e-

mail, an amended prescription was sent by e-mail. Diagnostic photos, which were made by an assistant, and the digital imaging photos that the business team member made for digital case presentation were downloaded onto a CD-ROM. This was then packaged and sent along with the case.

COMMUNICATION DURING LABORATORY PHASES

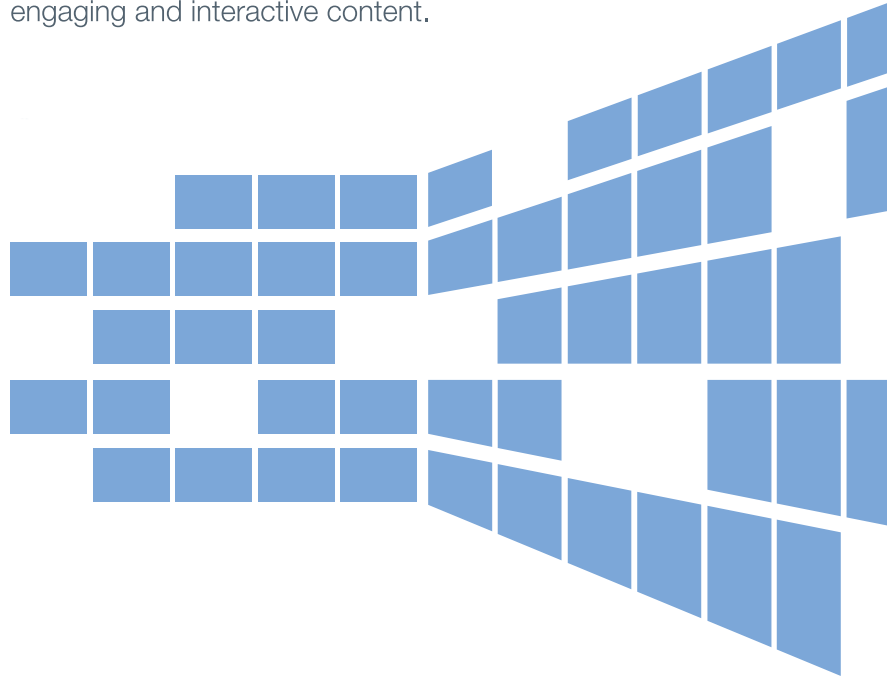
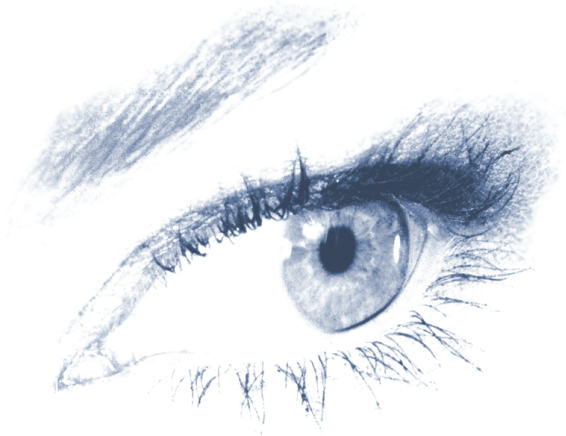
The case arrived at the laboratory with very specific instructions on how to proceed with the diagnostic wax-up. Instructions included information regarding incisal edge position, the buccal corridor, and

desired guidance. This information confirms the changes to improve the patient's smile line and occlusion. The casts supplied by the dentist were duplicated in a white presentation stone and articulated using the facebow transfer provided by the dentist on a Stratos articulator (Ivoclar Vivadent). We also received photographic records by e-mail and on a disc. We now use a free downloadable program called Dropbox to share photographs between the dentist's office and the laboratory. This program allows sharing photographs without the hassle of attaching pictures to e-mail or sending a disc to the laboratory. The photo-

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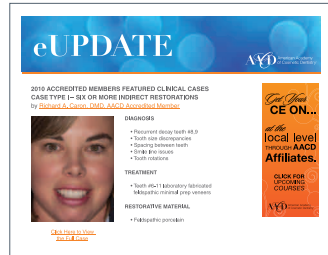
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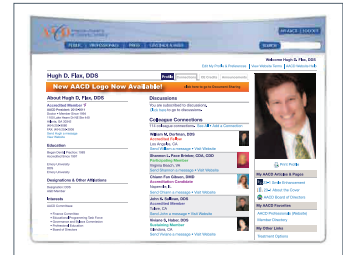
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Patient: XXXXXX
Rx Written: 8-4-09

Delivery date due: 8-20-09

Materials:

Tooth # material
4-13 dx wax up

Porcelain facial margins on #'s: If inadequate clearance
Spot die opposing call me

Shade of Prep (ND shade)

Tooth # ND
Tooth # ND
Tooth # ND
Tooth # ND

Check list by Dr's office

ND shades	surface shades
X length centrals	opposing model
X bite in IP=Centric	working impres
Protrusive bite	X photos
bite stick	X facebow
temp model	dx wax up
X pre-op models	implant parts

Length of centrals (incisal to zenith) #8_11mm #9_11mm
Special instructions: keep as #8 is after its excision.

Smile design:

incisal edges of 8 for the centrals, 10 for the laterals, and canines cusp tip a median point of both 6 & 11.

Occlusion notes: Mount on a Stratos articulator **Yes** / No

Assume unless specified differently – All teeth need an occlusal or an incisal centric stop.

Excursive desired: **Canine guidance.**

Instructions:

Dx wax # 4,5,9,11,12,13 crowns, 6,7,8,10 veneers.

Photos made prior to tissue recontouring and after ortho.

Gingival recontouring done prior to impressions taken: 7 & 8: 1mm tissue removed to make symmetrical with facial midline and as close as possible to symmetrical crossarch (knowing bony limitations).

Midline between 8 & 9 is perfect now please follow it. Existing 8 & 9 have no symmetry and incisal edges need correction to be same; if protrusive is not possible evenly at end to end position then recontour the mand incisors and mark the edges altered in red. Keep centric contacts.

Buccal corridor looks good (shape could be improved on right side and left occlusal plane at bicuspids is possibly long).

#6 is overly proclined (make it look more like #11 shape).

8-25-09 alterations needed as per discussion: Case looks great!!!!!! Being sent back for function with our articulator to be evaluated. Excursives do not flow smoothly along the guide table. Note the angles of excursive on the table provided. If a custom guide table was made and is being followed that could change the excursive angles that I would suggest, so let me know if you used one. Please flatten the excursive on patient's left side (now at 35 degrees) to be at least as shallow as her right side at 30 degrees. The movement has a "bump" to it.

Dentist name: Kathy Sanders, DMD, AAACD

License #: DS 5380

Figure 5: The dentist's complex laboratory prescription layout.

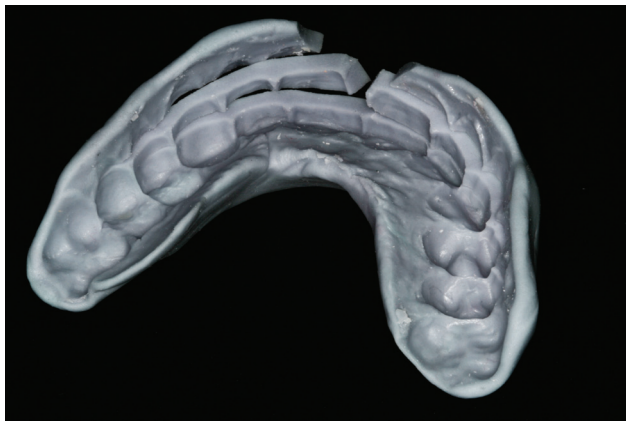


Figure 6: Examples of the Sil-Tech putty matrix preparation guide.



Figure 7: Mock-up of desired final shape from diagnostic wax-up using putty matrix.

graphs can be shared in their original format at whatever file size you want. The photographs greatly aid the technician in understanding the patient's needs. The images can help with design of the smile line, the appropriate midline, and evaluation of the buccal corridor. In this case, we could also see the differences in shades of the individual teeth.

The next laboratory phase was to use an additive wax technique on the study models. A gray wax (Thowax, Yeti Dental; Engen, Germany) was used to define where the contours were added.⁴ All centric contacts, protrusive movements, and cuspid guidance were refined at this stage of the treatment. A putty matrix (Sil-Tech, Ivoclar Vivadent) was made over the additive wax-up, the gray wax was removed, and the model was prepared to allow room for white presentation wax (Wonder Wax, Dental Ventures of America; Corona, CA) to be injected back into the putty matrix. The matrix was carefully removed and the wax cleaned up. Recordings of the anterior guidance and lateral guidance were recorded using a custom incisal guide table made for the Stratos articulator. These recordings were

again used during the fabrication of the final restorations. Gloss was added to the wax-up with Pledge floor finish (Johnson & Johnson; Racine, WI).

The case was returned to the dentist, along with a letter explaining the steps taken to make the diagnostic wax-up. Notes made were of tissue adjustments, occlusal clearance issues, and special preparation instructions for any troublesome areas that could easily endanger the success of the original treatment plan.

The day that the diagnostic wax-up arrived in the dental office (scheduled to take place one week prior to patient's appointment), the assistant responsible for coordinating lab cases prompted the dentist to review the case on the articulator for esthetics and function. The dentist desired excursive that were less steep than those provided.⁵ The laboratory technician was called and a modified lab prescription was written to confirm this conversation. The case was sent to the lab for these adjustments and any resulting esthetic changes that were needed.

After the modifications were made, the dental assistant accurately duplicated the diagnostic wax-up

in stone. The wax-up model was soaked in cool soapy water for about two minutes. Then the model was removed from the water and an alginate impression was immediately made. The model was promptly removed from the alginate to reduce the chance of the alginate sticking. Then the impression was poured using pink Snapstone (Whip Mix; Louisville, KY). The assistant then made two putty matrices (Sil-Tech). One putty matrix was modified to allow fold-back sections (Fig 6) to view preparations for further reduction needs at the level of the gingival third, body third, and incisal third. The second putty matrix was used for the mock-up and temporaries.

COMMUNICATION DURING PREPARATION AND TEMPORIZATION

A putty matrix was used to make a mock-up. No anesthetic was used while the enamel beyond the final arch form was removed. Due to orthodontics, there was minimal reduction. The patient's full sensation allowed the dentist and the patient to check the midline, general esthetics, and smile design in the patient's mouth. After anesthesia was delivered, this mock-up, retained by spot



Figure 8: The ND shade guide photograph was used to communicate the multiple shades of the prepared teeth.

etching enamel, served as the reduction guide for ## 4-13 (Fig 7). The assistant prompted the dentist to review any cautionary notes foreseen by the laboratory technician, guaranteeing the best result for the technician when working with the porcelain.

Photographs of the preparations were taken to depict differing ND shades (eight for this case) (Fig 8). A detailed written description of these was entered on the prescription. Temporaries were then made (Luxatemp, Zenith DMG; Englewood, NJ) with the use of the putty matrix. They were removed after one minute of set time, trimmed, and seated with Temp Bond Clear (Kerr; Orange, CA). Photographs, models of the temporaries, and bite registrations of the temporaries and preparations were enclosed with the case and sent to the lab. These diagnostics enabled the laboratory technician to see what underlying tooth color needed masking, bite registrations to allow the cross mounting of all working models and diagnostic wax-up models, and a model of the approved temporaries. The approved temporary model was the foundation and blueprint for fabrication of

the final restorations. The new bite registration was used to cross mount the previously mounted mandibular diagnostic wax-up model to the maxillary preparation model, negating the need for a new facebow.

LABORATORY PROCESS

After disinfecting the impressions and models, the impressions were poured with die stone (Xtreme Die Stone, HiTech; Greenback, TN), pinned, and based. The working model and model of the approved temporaries were mounted using the bite registration provided for cross mounting onto the Stratos articulator.

The patient's minor to moderate anterior bruxism was not a deterrent in choosing the porcelain material, due to the orthodontic and functional measures taken in this case. After thorough discussion and review of the digital records it was decided to fabricate the final restorations using Empress Esthetic (Ivoclar Vivadent) with the cut-back technique⁶ for ##4-13. Later, for compressive strength needed in the posterior (for #14 and #15), e.max (Ivoclar Vivadent) would be used.⁷

Due to the dark and inconsistent shade of the preparations (ranging from ND2 to ND8), sample crowns were fabricated. This would allow the dentist and laboratory technician to preview the brightness and opaquing capacity of the Empress Ingots EO2 and EO3 with the ND7 stump guides for each tooth. Photographs were taken and e-mailed to the dentist to review the results. We decided the EO3 ingot was far too opaque and much brighter than EO2; therefore, the EO2 ingot was chosen. It was opaque enough to block out the dark preparations and was the correct brightness to achieve the patient's desired shade of Chromascop BL1 (010). This case had a dynamic that would not be solved simply by following the manufacturer's recommended ingot choice. Normally the ingot of choice for the shade requested is Empress EO1, but after review of the case it was determined a more opaque ingot was required because of the inconsistent preparation shade and varying thickness of the Empress material.

After the model work was completed and verified, an incisal edge matrix of the temporaries was fabricated and used to guide in waxing of



Figure 9a



Figure 9b



Figure 9c



Figure 9d

Figures 9a-9d: Six-month postoperative photographs shared with laboratory technician.

the incisal edge position and shape of the final restorations. The crowns and laminates were waxed duplicating the model of the approved temporaries. Protrusive and lateral guidance were carefully refined during the waxing of the final restorations to ensure consistency throughout the manufacturing process, using the settings from the custom incisal guide table developed during the diagnostic wax-up. A new incisal edge matrix (Sil-Tech) of the finished wax-up was made to assist in the ceramic phase of manufacturing. The

case was then invested and pressed using Empress EO2 ingots.

After de-vesting, the crowns and laminates were seated and finished on the working model and the contacts adjusted on the solid tissue model. The incisal third of the crowns and laminates were reduced to make room for internal staining and layering of incisal ceramics. The incisal edge matrix made during waxing was used to control consistency of cutback of the crowns and laminates. An Empress Esthetic neutral wash was applied and fired in

the porcelain oven. A second wash was done to place internal effects before adding the layering ceramic. Low-value wash was applied to the mesial and distal corners. A high-value wash was applied to highlight the mesial and distal mamelons and a very light yellow wash was applied to highlight the center lobe. Opal incisal light (Empress Esthetic) was used to build the mesial and distal third of the incisal edge and Opal incisal medium was used to build in the middle third of the incisal edge.⁸ Using incisal porcelain with differ-



Figure 10: The patient's "I love my new smile" look.

ent translucency and value helps frame the tooth. A very thin layer of edge porcelain was applied to create a halo effect on the finished crowns and laminates.

After an add-on firing, the crowns and laminates were contoured to replicate the shape of the temporaries. The contacts were verified on the solid model and the final anatomy was contoured into the restorations. (A photograph of the finished bisque bake can be e-mailed to the dentist for feedback; if he or she is not near a computer, texting an image is helpful.) With the final shape verified, the restorations were glazed and polished using diamond polishing paste. The contacts, occlusion, and function were all verified one final time before the restorations were internally cleaned and etched (Ceram Etch, Keystone; Morristown, PA), before returning them to the dentist's office for try-in and cementation.

COMMUNICATION PRIOR TO DELIVERY

The restorations were evaluated by the dentist a week prior to the

seating appointment. Returns are rarely needed; however, a careful advance review can save the patient and the dentist chair time and undue stress. The laboratory technician sent a note along with the case, reviewing any adjustments that were made to preparation design.

The dentist tried in the restorations, looking for any tooth surface irregularities or contact tightness. These were adjusted for a seamless fit of the restorations. Trial cement (Insure, Cosmedent; Chicago, IL) allowed the dentist, patient, and team to review the shade. After the patient approved the new look, the restorations were seated (Insure). Any residual cement was removed and the occlusion adjusted (Figs 9a-9d).

CONCLUSION

Today's patients present with very high expectations. The dentist and clinical team must carefully interpret and then translate those expectations into a realistic clinical and laboratory approach that is appropriate for existing dentition and pa-

tient preferences. In this regard, the benefits of advanced AACD training are invaluable. Not all patients are candidates for the procedures they may have seen on television, and the dentist in particular has a responsibility to educate patients and guide them toward the optimum solution for their unique needs.

This is only the beginning, however. Once expectations have been discussed and understood, they must be clearly and precisely communicated to the laboratory technician for further input and refinement. Again, AACD training for the laboratory technician is invaluable; this training provides a common language for the communication process. Our experience in becoming Accredited members of the AACD led to similar educational opportunities; therefore, we both can easily communicate about smile design, elements of color, preparation design, periodontal health, occlusion and, finally, material choices.

The disciplined use of modern communication tools undergirds

this process and greatly enhances understanding between the laboratory and the clinical team. The process starts with the basics, including a comprehensive write-up of the clinical findings and desired outcome. Digital photographs, detailed prescriptions, and exceptional communication combine to make the case come alive in ways that could never be achieved with simple plaster models and x-ray film. Thanks to detailed communication, the laboratory technician was able to visualize both the functional and esthetic implications for this patient. The patient was exceptionally pleased with her new smile (Fig 10) and is looking forward to receiving veneers for her mandibular anteriors to complete her new look.

AACD training and advanced communication tools combined to yield a significant reduction in laboratory remakes for this case, as well as tremendous patient satisfaction.

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